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Determined were the educational and professional backgrounds, and some aspects of the operational environment of teachers of secondary school science and mathematics (Grades 7-12) in the public and private schools of the United States during the school year 1960-61. A stratified random sampling method was used to ensure proportional representation of teachers according to geographical region, size of school, grade levels within school, and number of classes of science and mathematics taught by individual teachers. Responses to a questionnaire were received from 3,012 teachers out of the original sample of 3,957 teachers. Some of the teacher data reported by region were age, sex, experience, course load, salary range, undergraduate and graduate education, and participation in NSF institutes. The data were analyzed and some recommendations made. The information is directed at providing assistance in designing inservice training programs and in developing academic programs for prospective teachers. (RS)

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Secondary School

SCIENCE and MATHEMATICS TEACHERS

Characteristics and Service Loads

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Report of a survey by the
National Association of State Directors of
Teacher Education and Certification
and the American Association for the
Advancement of Science
for the National Science Foundation

NSF 63-10

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I. INTRODUCTION: SCIENCE AND MATHEMATICS TEACHERS

The purpose of this survey was to ascertain the educational and professional backgrounds and something of the operational milieu of teachers of secondary school science and mathematics (grades 7–12) in the public and private schools of the United States during the school year 1960–61. The resulting information is expected to be of value in designing inservice training programs and in developing academic programs for prospective teachers.

The Survey

The construction of the questionnaire and the sampling procedure are described in some detail in appendix A. In brief, the sample was selected by the stratified random sampling method from the U.S. Registry of Junior and Senior High School Science and Mathematics Teaching Personnel, 1960–61, compiled by the National Science Teachers Association. This Registry contained names, school addresses, and other information for 142,377 teachers in all 50 States and the District of Columbia. The stratification was designed to ensure proportional representation of these teachers according to geographical region, size of school, grade levels within school, and number of classes in science and mathematics taught by the individual teacher. The sampling ratio of 1 in 36 applied to each of the strata produced a total sample of 3,957 teachers.

A questionnaire (reproduced in appendix B) was mailed in the spring semester of 1961 to each of these 3,957 teachers, 3,012 of whom returned usable questionnaires within the allotted time. Interviews later by telephone with half of the nonresponding teachers indicated that on the average they had somewhat less college preparation in science and mathematics subjects than was reported by the responding teachers, were less likely to have master's degrees, were less likely to have attended National Science Foundation institutes, and were teaching fewer classes in science and mathematics. The response rate was lowest among teachers in small schools (with enrollments under 100) but was otherwise fairly uniform throughout the school-size categories.

More detailed comparisons of the responding and nonresponding teachers are given in appendix A. In summary, nonresponse probably introduced into the tabulations (which are based upon the 3,012 usable questionnaires returned) a bias toward a slightly more favorable picture of teacher training and qualifications than would have resulted if the response rate had been 100 percent; but the distortion probably is small and does not effect the generalizations in this report.

Regional comparisons are made in the text and in the tables in appendix C. Twenty-four percent of the teachers in the sample were employed in the 9 States designated as the Northeast; 35 percent in the 13 North Central States; 26 percent in the 15 Southern States and the District of Columbia; and 15 percent in 13 States, including Alaska and Hawaii, comprising the West. All the States in each region are listed on page 13.

The Report

The study was intended to apply to all public or private secondary school teachers (grades 7–12) who during 1960–61 taught one or more classes in any of the following subjects: Mathematics, general science, biology, chemistry, and physics.

For some purposes it is convenient to consider these teachers in three groups: those who taught one or more classes in mathematics but none in the sciences, those who taught one or more classes in science subjects but none in mathematics, and those who taught both mathematics and science subjects. These groups are, of course, mutually exclusive. Their numbers in the sample are as follows:

Total in sample	3,012
Teachers of mathematics	1,280
Teachers of sciences	1,230
Teachers of mathematics and sciences	502

For other purposes, it is necessary to consider teachers grouped according to the particular sciences they teach. These groups are not mutually exclusive; a teacher who taught—for example—one class in general science and several classes in biology is included both in the

tabulations of general science teachers and in those of biology teachers. The numbers and percentages of teachers in the sample who taught in each of the subject categories were as follows:

	Number	*Percent*
General science	1,008	33
Biology	562	19
Chemistry	401	13
Physics	354	12
Mathematics grades 7–8	723	24
Mathematics grades 9–12	1,351	45
Mathematics grades 7–12	(1,782)	(59)

Number of Classes Taught

Since teachers of a given subject vary both in their competence to teach that subject and in the number of classes in which they teach it, the question arises, how many *students* or *classes* are affected by the presence in the teaching population of a particular percentage of teachers with little preparation in the subject taught? Although this study uses a sample of teachers, not of classes, estimates involving numbers of classes are made in several places in this report. These are approximations, but they should prove useful particularly in making comparisons among the science subjects. The method employed here is as follows:

In many of the tabulations the teachers are grouped in three categories based on the number of classes they taught in the subject under consideration: those who taught one or two classes, those who taught three or four, and those who taught five or more. Each of these groups is then further subdivided into other categories—on the basis, for example, of how many semester hours of college courses they had taken in the subject. An estimate of the total number of classes taught by teachers in one of these categories is derived by applying a factor of 1½ to the number of these teachers who taught one or two classes in the subject, a factor of 3½ to those who taught three or four classes, and a factor of 5 to the teachers who taught five or more classes (five being, in all but a very small number of cases, the maximum teaching load in a subject) and adding the three products.

In the text, most of the findings are expressed in percentages (usually of teachers, occasionally of classes). The text is by no means an exhaustive discussion of all the data collected, however; the reader interested in more detail is referred to the tables in appendix C, where the data are reported in the form of the number of teachers found in each of many categories.

AAAS Recommendations

Reference is made in chapters III and IV to the recommendations made by Cooperative Committee on the Teaching of Science and Mathematics, of the American Association for the Advancement of Science, regarding the preparation of these high school teachers. This committee, which consists of representatives of scientific societies and associations of teachers of the several subjects, published its recommendations initially in *School Science and Mathematics,* April 1959, and again, with minor revisions, in *Science,* April 8, 1960. The recommendations have since been useful in preparing a pamphlet, *Guidelines for Preparation of Teachers of Secondary School Science and Mathematics,*[1] published by the National Association of State Directors of Teacher Education and Certification and the AAAS. Copies may be obtained from NASDTEC–AAAS Studies, 1515 Massachusetts Avenue NW., Washington 5, D.C.

[1] The recommendations of the Cooperative Committee have been used in this report rather than the *Guidelines,* because the former are expressed in terms of semester hours. Data collected in this study are also in terms of semester hours.

II. THE TEACHERS AND THE SCHOOLS

A great deal of public attention is being centered upon the science curriculums of the secondary schools of this country and, in consequence, upon secondary school teachers of science and mathematics. It is evident that a gap exists between the education in science that has hitherto been required of entrants into the teaching profession and the demands that are now being made upon them, as teachers-in-service, to enlarge the scope of their teaching. Many efforts are afoot to narrow this gap, both by raising the standards of preparation to be required of future science teachers and by making opportunities for further study in the sciences readily available to teachers now in service.

But what are the dimensions of the gap that now exists? How much background does the average science or mathematics teacher have in

his subject? How long has it been since he studied it in college or graduate school? How likely is he to go back for further study after some years of teaching? Do the conditions in which he works encourage him to do so? These are the kinds of questions that led to the undertaking of the survey here reported.

In an educational system so diverse in its forms as ours, the term "the average science teacher" is of uncertain utility. It is more useful to think of science and mathematics teachers as a large and varied population working in a multiplicity of situations in which the opportunities, incentives, and demands for improvement differ markedly. It is therefore worthwhile to begin with a brief description of this population and of those of its working conditions about which information was obtained in the survey. This information is by no means comprehensive; for example, there is nothing about the laboratory facilities available to the teacher or about the percentage of college preparatory students in his school. Even so, the survey data reveal a good deal about the complex milieu in which the hoped-for improvement in secondary school science and mathematics teaching will have to take place.

Teaching Environment

Of the teachers in this study, about 90 percent were teaching in public schools and about 10 percent were teaching in private schools (see appendix C, table 5, for details).

The grade patterns of school systems in the country vary widely, a fact that may have more bearing on the teaching of science than of any other subject in the secondary school curriculums. Since each of the sciences (excluding mathematics) is with rare exception represented by a single 1-year course, and in junior high schools *all* may be represented by a single course in general science, it is obvious that the opportunity for the teacher to specialize in the teaching of a particular science, or even in the teaching of two sciences, depends upon the enrollment and the grade levels of his school.

Of the teachers reporting, 25 percent taught in 4-year high schools (grades 9–12), 12 percent taught in 3-year high schools (grades 10–12), 13 percent in 6-year secondary schools (grades 7–12), 17 percent in junior high schools (grades 7–9), 19 percent in combined elementary and secondary schools (kindergarten or first through 12th grade, K–12), and the remainder in schools with still other grade groupings. All these groupings are found in all regions of the country, but in different proportions, as shown in the following table:

School grade levels	Responding teachers (in percent), by region				
	Nation	Northeast	South	North Central	West
Total	100	100	100	100	100
K-12	19	12	24	23	9
7-9	17	17	17	14	25
7-12	13	20	15	9	4
9-12	25	28	15	27	33
10-12	12	11	13	10	19
Other	14	12	17	15	10

NOTE.—Percentages may not add to 100 because of rounding.

In the South and in the North Central States, but not elsewhere, large proportions of the teachers were working in K–12 schools. A larger proportion of the teachers in the West than elsewhere taught in 3-year junior high schools. The proportion of teachers in 4-year high schools was smaller in the South than in any other region. The proportion employed in 7–12 schools was high in the Northeast, very low in the West.

Almost a third of the responding teachers taught in schools with enrollments of less than 500, including 18 percent who were in schools of less than 300 pupils. There were, of course, variations among regions. A quarter of the teachers in the North Central States—a larger proportion than in any other region—taught in small schools with enrollments of less than 300 pupils. The West employed more of its teachers in large schools, with enrollments of 1,500 or more, than did any other region. Nationwide and regional patterns are shown in the following table:

Enrollment of school	Responding teachers (in percent), by region				
	Nation	Northeast	South	North Central	West
Total	100	100	100	100	100
Less than 300	18	11	17	24	18
300-499	14	12	17	15	10
500-999	30	35	32	29	25
1,000-1,499	19	22	20	18	20
1,500 or more	18	20	14	15	28

NOTE.—Percentages may not add to 100 because of rounding.

The actual statistical relations between school size and grade structure on the one hand and, on

the other, the variety of different subjects individual teachers were teaching are not presented in this report, but the extent to which the teachers were specializing in science or mathematics subject matter is discussed in chapter III.

The Teachers Themselves

Men predominate among these high school teachers, particularly in the subjects other than mathematics. Of the entire sample, 69 percent were men. Of the teachers who taught mathematics but no other science, 63 percent were men. Of those who taught sciences other than mathematics, 75 percent were men. The ratio of men to women was lowest in the South (59 percent), highest in the West (78 percent).

The rapid expansion of school facilities to cope with recent growth in the school-age population was reflected in the large number of young teachers and of very recent college graduates in the sample. Half were less than 35 years old, and only a quarter were 45 or older. Well over half had received their bachelor's degrees in 1950 or later—31 percent in the period 1950–56 and 27 percent in the period 1957–61. College graduates of the 1940–49 decade constituted only 18 percent—pre-1940 graduates, 24 percent—of the sample.

All but 1 percent of the teachers had earned at least bachelor's degrees. The largest number—about 4 out of 10—had been graduated from liberal arts colleges; the next largest number—3 out of 10—from teachers colleges; 2 in 10 from university schools of education; and 1 in 10 from other colleges within universities. The regional differences in this respect probably reflect variations in institutional patterns of higher education. Teachers in the sample from the West were more likely than those teaching elsewhere to have attended universities (either university schools of education or other university colleges) and least likely to have attended teachers colleges. These and other variations are shown in the following table:

Type of institution granting the bachelor's degree	Responding teachers (in percent), by region				
	Nation	Northeast	South	North Central	West
All types	100	100	100	100	100
Teachers colleges	29	28	32	30	21
Liberal arts colleges	39	47	40	36	35
University schools of education	20	14	18	23	24
Other colleges in universities	11	11	9	10	18
Other types	1	--	--	1	2

NOTE.—Percentages may not add to 100 because of rounding.

During the latter part of the 1950's there appears to have been a trend away from the liberal arts college and toward the teachers college. Of the teachers who took their bachelor's degrees during the period 1950–56, 41 percent took them at liberal arts colleges and 27 percent at teachers colleges; among those who took their degrees later, the percentages from the two kinds of institutions were almost exactly equal. The following table shows these trends by year up to the time of survey:

Type of institution granting the bachelor's degree	Responding teachers (in percent), by year of bachelor's degree				
	All degree holders	Before 1940	1940–49	1950–56	1957–61
All types	100	100	100	100	100
Teachers colleges	29	25	29	27	33
Liberal arts colleges	39	43	39	41	34
University schools of education	20	18	18	21	22
Other colleges in universities	11	13	13	10	10
Other types	1	1	1	1	1

Most of the teachers had at some time taken courses beyond those required for their bachelor's degrees. Thirty-nine percent held master's degrees; a few—less than 1 percent—held doctorates; over 75 percent held credits for at least 10 hours of graduate work; and even after having attained master's degrees, many had accumulated substantial credit for additional course work. The figures may be seen in tables 10 and 11 in appendix C. (How much of this postbaccalaureate work was devoted to the subjects they were teaching is a question reserved for chapter IV.) The Northeast had the highest proportion of teachers reporting advanced degrees (46 percent, including most of the doctorates reported in the survey); the South had the lowest (32 percent). Twenty percent had completed at least one National Science Foundation summer institute; regional differences in this respect were small.

Service Loads and Salaries

How the teachers' time was divided among science classes and classes in other subjects is considered in chapter III. Their total working time probably did not differ appreciably from that of other secondary school teachers. Their own estimates of the length of their workweek averaged 45 hours. Of this, 23 hours were spent in teaching in the classroom or laboratory; 17 hours were spent in activities related to teaching, such as

lesson preparation, paper grading, study hall supervision, and administrative work, and in nonacademic teaching such as athletics, band, or dramatics. The remaining 5 hours were devoted to such tasks as lunchroom supervision and bus duty. Regionally, the shortest workweek, on the average, was about 42 hours, reported by teachers in the Northeast; estimates of the Southern teachers averaged more than 45 hours and those of North Central and Western teachers more than 46. The differences were accounted for mainly in the amount of classroom time.

Individual salaries ranged from below $3,000 to over $10,000, with the national median in the range $5,000–$5,499. Regional variations were marked, the median for the South falling below $4,500 and for the West above $5,500. The following table summarizes salary information shown in table 9, appendix C.

Annual salary	Responding teachers (in percent), by region				
	Nation	Northeast	South	North Central	West
Total	100	100	100	100	100
Under $4,000	18	13	40	10	6
$4,000–$4,999	29	25	36	30	22
$5,000–$5,999	24	26	15	28	27
$6,000–$6,999	15	19	6	16	24
$7,000 or more	14	18	3	16	21

NOTE.—Percentages may not add to 100 because of rounding.

III. SPECIALIZATION IN SUBJECTS TAUGHT

In its recommendations regarding the preparation of high school science and mathematics teachers,[1] the Cooperative Committee on the Teaching of Science and Mathematics, of the American Association for the Advancement of Science, points out that "In a 4-year program for teachers it seems almost impossible to prepare them to teach in widely divergent areas: for example, English teachers to teach physics, or social science teachers to teach chemistry, or physical education teachers to teach mathematics." Do high school teachers now commonly teach "in widely divergent areas"? To what extent are science classes assigned to teachers who are also, and perhaps even primarily, teaching subjects unrelated to science?

The survey answered this question as follows:

> Sixteen percent of the teachers teaching sciences (including mathematics) had only one or two classes in the science area. These teachers clearly were required to put most of their time into unrelated subjects.
>
> Twenty-eight percent, taught three or four classes in science subjects (including mathematics), which means they were putting some of their time, but not the major share, into unrelated subjects.[2]
>
> Fifty-six percent were teaching five or more classes in science subjects (including mathematics) and may be designated as full-time science teachers.

From these figures, it is estimated that—

> Six percent of the science and mathematics classes were taught by teachers most of whose time was given to unrelated subjects.
>
> Twenty-four percent of the science and mathematics classes were taught by teachers who gave most of their time to these subjects but some of it to unrelated subjects.
>
> Seventy percent of the science and mathematics classes were taught by full-time teachers of these subjects.

But a typical high school science curriculum includes—in addition to several successive courses in mathematics and a course in general science—a course in each of three distinct science subjects: biology, chemistry, and physics. As the AAAS Committee recommendations indicate (see chapter IV), the teaching of any one of these subjects so as to meet current educational demands requires that the teacher's own education should have made him something of a specialist in it. This raises the question: To what extent do their work programs permit science and mathematics teachers to concentrate upon particular subjects?

There are, of course, wide variations from one subject to another in that regard. Even a small high school is likely to have enough classes in mathematics to occupy the full teaching time of at

[1] Cooperative Committee on the Teaching of Science and Mathematics, "Preparation of High School Science Teachers," *Science*, Apr. 6, 1960 (vol. 131, No. 3406).

[2] In some cases, but presumably a very small minority, four or even three classes may constitute a full teaching load, the remaining time being assigned to administrative or extracurricular duties.

least one teacher, but only the largest or most specialized high schools have enough classes for a full-time physics teacher. The variations show up clearly in the accompanying table, which shows that, among the teachers of mathematics in the survey, a large proportion were teaching five or more classes in that subject, whereas in biology, chemistry, and physics the proportions teaching five or more classes were very small. Most of the physics, chemistry, and biology teachers were teaching only one or two classes in these subjects.

Subject taught	Percentage distribution of teachers, by number of classes in subject			
	Total	1 or 2	3 or 4	5 or more
General science	100	49	24	27
Biology	100	53	32	15
Chemistry	100	68	26	6
Physics	100	81	15	4
Mathematics (grades 7–12)[1]	100	29	28	43

[1] In most of the subsequent discussion of mathematics classes and in the tables in appendix C, mathematics 9–12 and mathematics 7–8 are treated separately.

Since teachers with only one or two classes in a given subject may be assumed to be giving most of their teaching time to other classes, estimates from the table above suggest that most of their time was being given to other subjects by teachers of—

63 percent of the physics classes,
45 percent of the chemistry classes,
30 percent of the biology classes,
25 percent of the general science classes, and
12 percent of the mathematics classes.

Teaching Combinations

"If multiple teaching assignments are necessary," the AAAS Committee report observes, "there are favorable combinations such as physics and mathematics, chemistry and physics, and biology and health." What combinations are now current? Do "favorable" ones prevail?

It may be noted first of all that a "favorable combination," in the Committee's examples, is always a pair, whereas the survey turned up many instances of teachers teaching three or more different science subjects at the same time. The two-, three-, and four-subject combinations reported in the survey were so varied that it was not deemed useful to tabulate them in full detail, but tables 19, 24, 29, 34, 39, and 44 in appendix C give some idea of the great variety of subject-matter demands currently being made upon high school science teachers. The following observations are based on those tables.

The proportions of teachers involved in each subject should be noted first. In descending order, they are as follows: 45 percent of the teachers in the study taught one or more classes in upper-level (grades 9–12) mathematics; 33 percent taught one or more classes in general science; 24 percent, one or more classes in seventh- or eighth-grade mathematics. In biology, chemistry, and physics the figures were 19 percent, 13 percent, and 12 percent, respectively. Since the discussion here involves, in effect, how these groups overlap—that is, how many members of one group (e.g., physics teachers) also belong to another (e.g., mathematics 9–12 teachers)—two different figures may apply to one group of teachers. Thus, the statements that 37 percent of the physics teachers taught mathematics 9–12 and that 10 percent of the mathematics 9–12 teachers taught physics are reporting identical data. Both statements are essential to an understanding of teaching conditions in the two fields.

Principal teaching combinations for teachers of the subject-matter fields in the survey appear in the following discussions.

Physics teachers. Presumably the most appropriate combinations with physics would involve mathematics, chemistry, or general science. More than 80 percent of all physics teachers taught at least one of those subjects (including 28 percent who taught two or all three of them): 42 percent taught chemistry, 37 percent taught mathematics 9–12, and 32 percent taught general science. Perhaps less to be expected is that 24 percent taught biology. (More than a quarter taught two or all three of those subjects in addition to chemistry.) Mathematics 9–12 was taught by 27 percent, most of whom also taught a third (or a third and a fourth) science subject.

Biology teachers. There were considerably more high school classes in biology than in either chemistry or physics; there were more teachers of biology, and a much larger proportion of them had at least three classes in the subject (47 percent compared with 32 and 19 percent). Forty percent of all biology teachers in the survey taught general science; 23 percent taught chemistry (of whom half also taught general science).

Mathematics teachers. Of all the secondary school mathematics teachers, 24 percent taught that subject at the 7th- and 8th-grade level

only, 59 percent taught it at the 9th- to 12th-grade level only, and 16 percent taught it at both levels. A five-class teaching load in mathematics was much less common in the first group (seventh-and-eighth-grade level) than it was in the other two. Of those who taught mathematics at both levels, 65 percent had as many as five classes in the subject; of those who taught only mathematics 9–12, 44 percent had five classes; and of those who taught only mathematics 7–8, 29 percent had five classes. Of teachers of mathematics 7–8, 27 percent also taught general science. Of the teachers of mathematics 9–12, 11 percent taught general science, 10 percent taught physics, and 8 percent taught chemistry.

General science teachers. Since large percentages of the teachers of physics, chemistry, biology, and mathematics were teaching general science, it is interesting to find that there was nevertheless a sizable group—27 percent of the very numerous general science teachers—who may be said to have been specializing intensively in that subject in the sense that they were teaching at least five classes in it. In numbers, this group was more than twice the size of the group teaching *three* or more chemistry classes, four times that of the group teaching *three* or more physics classes, and equal to the group teaching *three* or more biology classes. Only in mathematics 9–12 was there a larger group with a five-class teaching load in one subject.

Summary

The survey shows that the secondary schools afford teachers considerable opportunity to specialize in the teaching of mathematics or general science, but much less in the teaching of biology, chemistry, or physics. Physics showed the least opportunity to specialize: only 12 percent of the teachers in the survey were teaching physics, and four out of five of these had only one or two classes in that subject. Chemistry is only somewhat better off: 13 percent of the teachers were teaching chemistry, and more than two-thirds of those had only one or two classes in it. Biology is most favorably situated of the three: 19 percent were teaching it, and only slightly over half the teachers of biology had only one or two classes in that subject.

Even when all five subjects—biology, chemistry, physics, general science, and mathematics—are combined under the heading of science teaching, it appears that not much over half the teachers in the survey were teaching science exclusively, and 30 percent of all the science and mathematics classes were being taught by teachers who gave some or even most of their teaching time to subjects entirely outside the area of this inquiry.

IV. PREPARATION OF THE TEACHERS IN THEIR SUBJECT MATTER

In chapter II it is noted that 99 percent of the teachers in the survey sample held bachelor's degrees, 39 percent had master's degrees, and many had substantial amounts of course work to their credit beyond that required for their degrees. In this chapter, the amount of course work the teachers had taken in the science subjects they were teaching is examined. The measure used is the total number of semester hours of credit, whether earned during undergraduate or postgraduate years, that biology teachers had taken in biology courses, mathematics teachers in mathematics courses, and so on.

AAAS Recommendations

It may be useful to summarize first the pertinent recommendations of the AAAS Committee previously referred to. After taking into account the variety of purposes that the education of a teacher must serve, the recommendations call for 4-year programs in which about half the work (roughly 60 semester-hours) would be devoted to science courses, followed by a fifth year (approximately 30 more semester-hours) of graduate work in science. Half the undergraduate science courses would be in the "major"—the particular science the student hopes to teach. The other half would be divided between a science "minor" and related science courses. The postgraduate courses would be similarly divided.

More specifically, biology teachers would earn 33 hours of credit in biology as undergraduates and 14 more as graduate students (total, 47 hours). Chemistry teachers would earn 28 undergraduate and 15 graduate credits in chemistry; physics teachers would earn the same in physics (total, 43 hours). Mathematics teachers would complete 30 undergraduate and 15 graduate hours in their

subject (45 hours). Two special programs—one to prepare teachers to teach both physics and chemistry (physical science), the other to prepare for teaching mathematics along with one other science—are also suggested. In these, 18 undergraduate hours would be devoted to each of the subjects to be taught, and 12 more in the postgraduate year, for a total of 30 semester hours in each subject. It is assumed that the completion of a college major in biology, chemistry, physics, or physical science—with their related studies—would prepare the teacher to teach general science; but also suggested, to prepare junior high school teachers for a general science specialty, is a 4-year program in which the hours usually assigned to a major and minor would be divided among biology, chemistry, and physics.

These recommendations are only 3 years old, and they set standards for credits in the teaching specialty much higher than those that have prevailed for many years. They may, however, provide the reader with some benchmarks for the observations that follow.

Survey Findings

Number of College Credits

In this report, the teachers are separated in four categories by the number of college credits they had received at the time of the survey in the subjects they were teaching: 30 or more hours, 18–29 hours, 9–17 hours, and less than 9 hours. In addition, each of these categories is subdivided into two groups—teachers with 9 or more hours and teachers with less than 9 hours in a closely related science, e.g., mathematics in the case of chemistry and physics teachers, or chemistry in the case of biology teachers. The resulting data are shown in detail in tables 17, 22, 27, 32, 37, and 42 in appendix C. The following table summarizes some of these data:

Teaching subject	Percentage distribution of teachers of subject, by semester hours of college credit in subject				
	Total	Less than 9 hours	9–17 hours	18–29 hours	30 hours or more
General science (biology credits)	100	34	21	19	26
Biology	100	11	16	22	51
Chemistry	100	16	23	31	29
Physics	100	26	41	20	12
Mathematics 7–8	100	38	18	24	20
Mathematics 9–12	100	15	15	31	39

NOTE.—Percentages may not add to 100 because of rounding.

Biology had the highest proportion of teachers in the top category: 5 out of 10 biology teachers, 4 out of 10 mathematics 9–12 teachers, and 3 out of 10 chemistry teachers had at least 30 semester hours of credit in their subject matter. Only 12 percent of the physics teachers had as much as 30 hours in physics, and 26 percent were in the lowest category with less than 9 hours.

Since so many teachers teach more than one science, and the AAAS recommendations for teachers preparing to teach two subjects call for the completion of 18 hours in each during the 4-year undergraduate program (with 12 more to be taken in a fifth year), it seems appropriate to speak of 18 hours as a minimum standard of adequacy of preparation. It would then appear that the preparation of 73 percent of the biology teachers, 70 percent of the mathematics 9–12 teachers, 60 percent of the chemistry teachers, and 32 percent of the physics teachers in the survey met such a standard.

In each of these subjects, the teachers who met the 18-hour standard were more likely (than those who did not meet the standard) to have taken some college work in the related science on which tabulations were made. Of the biology teachers with 18 or more hours of credit in biology courses, 58 percent had 9 or more hours in chemistry; of those with less than 18 hours in biology, only 41 percent had 9 or more hours credit in chemistry. Among mathematics 9–12 teachers, with the "related subject" physics, the comparable figures were 43 and 19 percent. In chemistry, with the related science mathematics, the comparable figures were 77 percent and 51 percent. In physics, with the second subject again mathematics, the comparable figures were 93 percent and 65 percent.

The largest percentages of teachers with little or no college preparation in subjects they were teaching were found in the two junior high school subjects, general science and mathematics 7–8. The particular science here tabulated for general science teachers is biology, because it is the one in which most general science teachers had the largest number of credits. A third of the general science teachers had less than 9 hours in biology. Many of these same teachers had less than 9 hours in chemistry also.

In mathematics 7–8 the proportion of teachers with less than 9 hours in their subject was even higher than in general science—almost two out of five.

The teachers with little preparation were somewhat more likely to be teaching only one or two classes than were those who were better prepared, but the difference was not sufficient to improve the situation greatly, as may be seen by comparing the next table with the one just discussed.

Teaching subject	Estimated percentage distribution of classes, by teachers' college credits in subject				
	Total	Less than 9 hours	9–17 hours	18–29 hours	30 hours or more
General science (biology credits)	100	31	21	20	28
Biology	100	8	13	22	57
Chemistry	100	14	20	32	34
Physics	100	23	43	20	14
Mathematics 7–8	100	34	19	26	21
Mathematics 9–12	100	11	12	32	45

Thus, about a quarter of the physics teachers had less than 9 hours of credit in physics, and about a quarter of all the physics classes were taught by these teachers; a third of the physics teachers had 18 or more hours of credit in physics, and a third of all the physics classes were taught by them. This is the result not only of the small ratio of adequately prepared physics teachers but also of the fact that most of the physics teachers, including the well-prepared ones, taught only one or two classes in that subject.

Classes in the two junior high school subjects—mathematics 7–8 and general science—were most seriously affected, about a third being taught by teachers with little or no college work in the subjects. The figure for general science here is again based on the teachers' preparation in biology; it may be added that 57 percent of the general science classes were taught by teachers with fewer than 9 hours in chemistry, 21 percent by teachers with fewer than 9 hours both in biology and in chemistry.

Recency of College Credits

Because of the rapid developments in the sciences during the last decade and the pressures these developments have exerted on the high schools to change and expand their science curriculums, the recency of science teachers' education in their subject matter is almost as much concern as the quantity. Many of these teachers in the sample had master's degrees and most of them had done graduate work.[1] The question naturally arises, how many had done some work beyond the bachelor's degree in the sciences they were teaching, and how recently?

The answer appears in tables 18, 23, 28, 33, 38, and 43 in appendix C. In tables 16, 21, 26, 31, 36, and 41 are shown details of the total amount of graduate work taken, irrespective of subject. Data from the two sets of tables, showing teachers with graduate work up to the time of the survey, are summarized as follows:

Teaching subject [1]	Percentage of teachers with at least 10 hours graduate work in any subject [2]	Percentage, by year, with graduate work in subject they were teaching		
		Any year	1950–61	1957–61
Biology	76	42	36	29
Chemistry	81	37	32	28
Physics	85	37	32	30
Mathematics 7–8	67	20	19	15
Mathematics 9–12	77	37	33	29

[1] The general science teachers are omitted because in order to do them justice in this context their graduate courses in all the sciences should be tabulated, and only tabulations for biology have been completed (see table 18, appendix C). Twenty-four percent of the general science teachers had some graduate courses in biology; 17 percent had such courses in 1957 or later.

[2] Includes all holders of master's and doctor's degrees and those holders of bachelor's degrees who reported 10 or more semester hours credit for graduate work in any subject.

The data show that, except in biology, less than half the teachers who had done 10 hours or more of graduate work had done any of it in the science they were teaching, and in mathematics at the junior high school level the percentage was particularly low.

As to recency, the table shows that if a teacher had taken any postbaccalaureate work in his subject at all (by the time of the survey, spring 1961), he was very likely to have done at least some of that work since 1950, even since 1957. This suggests that perhaps the more recent entrants into the profession—say, those who took their bachelor's degrees in the 1950's—were more likely to have taken these courses than were the earlier entrants. Almost half the teachers of chemistry, physics, or mathematics 9–12 and about a third of the teachers of biology or mathematics 7–8 received their bachelor's degrees before 1950. How do they compare, in recency of graduate work in their subjects, with those who received their degrees later?

[1] The word "graduate" here is intended to include, for some teachers, postbaccalaureate courses normally offered in undergraduate programs.

Among the teachers who received their degrees before 1950—

33 percent of the biology teachers,
31 percent of the chemistry teachers,
30 percent of the physics teachers,
18 percent of the mathematics 7–8 teachers, and
34 percent of the mathematics 9–12 teachers

had taken courses in their subject *since 1950.*

Among the teachers with bachelor's degrees taken during the period 1950–61—

39 percent of the biology teachers,
33 percent of the chemistry teachers,
34 percent of the physics teachers,
20 percent of the mathematics 7–8 teachers, and
34 percent of the mathematics 9–12 teachers

had taken courses in their subjects since receiving the bachelor's degree.

Thus, there is a difference, but a very small one, in favor of the teachers with the more recent degrees. A more detailed analysis of the appendix C tables, however, indicates that there is greater variability than the foregoing summary reveals. For example, if the newest graduates—those with bachelor's degrees dating in the period 1957–61—are eliminated from the reckoning, the differences in favor of the relatively new teachers (with degrees taken during the period 1950–56) are considerably greater. And the teachers who received their degrees in the 1940's scored higher than those who took theirs before 1940. The details, for college experience at the time of the survey, are summarized in the following table:

Subject taught	Teachers of subject, by year of bachelor's degree			
	Before 1940	1940–49	1950–56	1957–61
	Percentage with graduate credits in subject earned 1950–61			
Biology	30	37	48	29
Chemistry	23	47	41	23
Physics	28	34	47	16
Mathematics 7–8	19	16	28	12
Mathematics 9–12	29	40	43	24
	Percentage with graduate credits in subject earned 1957–61			
Biology	21	23	39	29
Chemistry	20	37	36	23
Physics	25	33	43	16
Mathematics 7–8	17	10	23	12
Mathematics 9–12	27	31	36	24

Because some of the subsamples involved in the table are small, slight differences between any two percentages may not be reliable; a detailed interpretation of them is therefore not attempted. It is clear from the table as a whole, however, that—leaving aside the very recent graduates—the farther the teacher is from his undergraduate days, the less likely he is to take additional work in his subject. Nevertheless, some teachers do so many years after taking their bachelor's degrees; in this survey, one out of every four or five high school science teachers who took their bachelor's degrees before 1940 had taken at least one course within the last 4 years [2] in a science that he was teaching.

Participation in NSF Programs

In choosing courses for further study, National Science Foundation summer institutes rank high among teachers of the sciences. Twenty percent of the teachers in the sample (appendix C, table 14) had completed at least one such institute, If this figure could be used to determine numbers of high school classes affected, it is probable that the percentage would be considerably higher, since teachers who spend most or all of their teaching time in the sciences or in mathematics would more likely attend these summer institutes than would those doing most of their teaching in other fields.

Courses under other sponsorship—i.e., local school systems, the States, and industry—were relatively low in teacher participation, as were other NSF programs.

Summary

In terms of semester hours of college credit for courses in the subject they were teaching, biology teachers ranked first, followed by mathematics 9–12 and chemistry teachers. Physics teachers fell far behind, and about a quarter of the physics classes were taught by teachers with less than 9 hours of college credit in that subject. If 18 semester hours may be regarded as representing a minimally adequate preparation for teaching science in high school, then it is estimated that approximately—

21 percent of the classes in biology,
23 percent of the classes in mathematics 9–12

[2] 1957–61, to the time of the survey. Since these were working teachers, very few of the respondents had taken courses during calendar year 1961.

34 percent of the classes in chemistry, and
66 percent of the classes in physics

were being taught by inadequately prepared teachers.

For teachers of mathematics 7–8 and general science, a lesser degree of preparation might be expected, but many classes in those subjects benefit from being taught by teachers who also teach sciences in the upper grades; and by the AAAS 18-hour standard, both these subjects appeared in a more favorable light in the survey than did physics. In mathematics 7–8, 53 percent of the classes were being taught by "inadequately prepared" teachers, according to the AAAS-recommended standard. But whereas in physics such teachers tended to fall into the 9-to-17-hour category, in mathematics 7–8 they were most often in the less-than-9 category.

Most general science teachers had more preparation in biology than in any other subject; but an estimated 52 percent of the general science classes were taught by teachers with less than 18 hours of biology, 56 percent were taught by teachers with less than 9 hours of chemistry, and 23 percent were taught by teachers with less than 9 hours in either of these subjects.

Although over 75 percent of the teachers in the survey had done graduate work of some sort, less than 40 percent (a little more in biology, considerably fewer in the junior high school subjects) had taken any graduate work in the sciences they were teaching. If a teacher had done such work, he was very likely to have done at least part of it quite recently. In each of the four senior high school sciences, about 30 percent of the teachers had in early 1961 taken such courses in their subjects within the last 4 years, and teachers whose bachelor's degrees dated back 20 years or more seemed to be fairly well-represented among them.

V. CONCLUSIONS

The impression that emerges most strongly from the survey findings is that, except in mathematics, opportunities to specialize in the teaching of a single scientific discipline are distinctly limited. According to these findings, 8 out of 10 teachers of physics are primarily teachers of something else, and so are 7 out of 10 teachers of chemistry. Chemistry and physics are a common teaching combination, but so are chemistry and biology, chemistry and mathematics, and of course chemistry and general science; and many chemistry (or physics) teachers teach not two science subjects but three. Biology teachers less often teach other subjects, but in the combination biology and general science, which prevails widely, as often as not the major share of teaching time is devoted to general science.

With the increase in the number of high school students preparing for college, the need for more high school science classes—and therefore the opportunity for teaching specialties in science—will presumably continue to grow; but for individual teachers there is also the problem of getting enough such classes under their own schoolhouse roof. The survey showed over 60 percent of these secondary school teachers were teaching in schools with enrollments of less than a thousand pupils, and in many schools of such size—depending on their grade structure and on the proportion of college-preparatory students—the opportunities for specialization are bound to continue to be limited.

It would be ideal to have every high school science class taught by a teacher who has a substantial education in the subject and who can keep his knowledge reasonably up to date. Any estimate of how far the Nation's high schools are from this goal must depend upon somewhat arbitrary standards of measurement; but it seems moderate enough to say that a teacher who has less than 18 semester hours of college work in a science does not have a substantial education in it, and we have seen that two-thirds of the physics classes, a third of the chemistry classes, and more than a fifth of the biology classes and the upper-level mathematics classes are taught by such teachers. Many physics classes, and in fact large numbers (if small percentages) of the classes in every high school science subject, are taught by teachers who have had only a single 1-year college course in the subject—or even none at all.

It has been shown by the AAAS committee of scientists and scientist-educators referred to in this report how a prospective teacher may achieve the modest 18-semester-hour standard in each of two science subjects within a 4-year undergraduate program, along with the necessary but lesser amounts of study in the other sciences, with "preparation in the social sciences and humanities to help give him the kind of perspective that we

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like the scholar and citizen to have," and with those "elements in professional education which should be helpful in giving the best performance in the classroom." Thus prepared, with 1 additional year of study in his two principal sciences he could equip himself to function effectively in the demanding situation with which science teachers are confronted.

As for teachers now in service, the science and mathematics teaching population is surprisingly young, which means that these teachers may affect the quality of secondary school education in these subjects for a long time. Many are well- or fairly well-educated in their subjects and for this reason will be able to take advantage of whatever opportunities are afforded by such programs as the National Science Foundation institutes or by conventional graduate study to improve their knowledge and their teaching skills as necessary. The other teachers—and they constitute a majority of the teachers of physics, a large minority of the teachers of chemistry, and smaller but significant minorities in biology and mathematics—fall into two groups: those who have had little, if any, college preparation in the subjects they teach and those who have had more but not enough. It seems probable that the teachers in the first group would welcome reassignment to the subjects that they prepared themselves to teach, and that the amelioration of their condition and that of their students must depend upon improved planning within the school systems where they are employed.

The second group requires closer study. If a teacher has had (to use another arbitrary measure) 9–17 semester-hours of college work in a subject, has some experience teaching it to high school classes, and has some educational background in other science subjects as well, it would appear that he has potentialities that should be further developed. Such a teacher may well have insufficient formal education in the particular science to qualify to take further courses in it for graduate credits. Moreover, conventional science courses at advanced levels may be too narrow or too specialized to serve his professional needs efficiently. For such teachers, special new kinds of programs need to be made readily available. A great asset in the drive to improve secondary school education in this country is the demonstrated willingness of the teachers to take graduate courses; the problem is to make it practicable for them to spend more of these energies in studying the growing subject matter of the sciences they are teaching.

APPENDIX A

METHODS EMPLOYED IN THE SURVEY

Sample Design

The sample was intended to represent as accurately as practicable all teachers of science and mathematics classes in the public and private secondary schools of the United States in the spring of 1961. It was drawn from the U.S. Registry of Junior and Senior High School Science and Mathematics Teaching Personnel, 1960–61, which contained names and school addresses of 142,377 teachers in the 50 States and the District of Columbia along with selected items of information concerning their schools and their teaching assignments. This Registry was established by the National Science Teachers Association from data obtained through a questionnaire sent in the fall of 1960 to principals of public and private secondary schools, of whom approximately three-quarters responded with lists of teachers teaching one or more classes in science or mathematics in their schools.[1]

While the population list did not represent a complete count of all science and mathematics teachers (grades 7 through 12) in the United States, it was the best obtainable for purposes of this study. The use of such a list permitted careful stratification and reasonable sampling costs. Without such a list the identification of science and mathematics teachers probably would need to be approached through a sampling of schools or school districts, which in turn would have introduced cluster sampling error and complicated the collection of data.

The plan used in sampling from the Registry involved the following steps:

(1) For each teacher, a punched card was prepared showing school location, school enrollment, grades within school, and number of science and mathematics classes taught by that teacher.

(2) These cards were sorted into four categories representing the geographical regions as follows:[2]

Northeast: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont.

South: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, South Carolina, Tennessee, Texas, Virginia, West Virginia.

North Central: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, Oklahoma, South Dakota, Wisconsin.

West: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming.

(3) Within each region the cards were then sorted into 6 school-enrollment categories: (a) under 100, (b) 100–199, (c) 200–299, (d) 300–499, (e) 500–999, and (f) 1,000 or more.

(4) Each of the resulting 24 groups was then sorted into 5 categories corresponding to the number of secondary school grades included within the school: (a) grades 7–8 and grades 9–12, (b) grades

[1] The list of public schools that was used for this purpose is contained in *Enrollment, Teachers, and School-Housing, Fall 1960*, published by the U.S. Office of Education. The names of the private schools were obtained from an unpublished list of 4,193 private secondary schools prepared in the school year 1959–60 by the U.S. Office of Education.

The extent to which nonresponding schools may have biased the Registry is not clear. Speculation suggests the possibility that the nonresponding schools may have included a larger proportion of small schools or schools in which there was no clear indication of instructional assignments in science and mathematics. On the other hand, it is also possible that the nonresponding schools would contain substantial numbers of teachers whose characteristics were distributed similarly to those of teachers on the list.

[2] The regional distribution of science and mathematics teachers in the Registry may be compared with that of full-time and part-time secondary school teachers in all subjects:

Teacher group	Percentage distribution				
	Total	North-east	South	North Central	West
Science and mathematics teachers in Registry	100	24.3	30.2	29.7	15.8
All secondary school teachers	100	25.5	30.8	27.4	16.3

7–9, (c) grades 7–12, (d) grades 9–12, and (e) grades 10–12.

(5) Each of the foregoing 120 piles was then subdivided according to 2 teaching-assignment categories: (a) 50 percent or more science or 50 percent or more mathematics and (b) all others.

These procedures yielded a total of 240 mutually exclusive piles of cards. Systematic sampling from a random start was then carried out separately within each of the 240 piles, with a constant sampling ratio of 1 in 36 cards, which yielded a self-weighting total sample of 3,957 teachers. This sample represented 2.8 percent of the names in the Registry.

Design and Testing of the Questionnaire

The questionnaire was based on suggestions made by scientists and educators concerned with the problems of preparing, certifying, and employing teachers. A first draft was tested with teachers participating in National Science Foundation summer institutes at the University of Arizona, Tucson, during the summer of 1960. A later draft was tested with secondary school science and mathematics teachers in Indiana. It was also tested with secondary school science and mathematics teachers in Montgomery County, Md., and Washington, D.C., who were later interviewed concerning problems with which they were confronted in filling out the questionnaire.

One of the major objectives of the survey was to obtain estimates of the teachers' preparation or educational qualifications for teaching science and mathematics classes. A large share of the questionnaire concerns information about the teachers' formal education in these fields. In planning the questionnaire it was recognized that, while quantity and kind of education are by no means the only personal factors related to effective teaching, this information would be indispensable to large-scale planning of inservice training programs.

Another objective was to ascertain the kinds of setting in which the teachers function. Certainly teachers are more likely to be able to teach well if their work assignments are in subjects for which they are prepared, and the report gives considerable attention to findings related to this factor. Their effectiveness is also likely to be enhanced if the size of classes permits some individual guidance of students, if they do not have a heavy burden of nonteaching assignments, and if salaries reflect community recognition of the importance of their function. The questionnaire attempted to gather some information about these factors also, although a judgment of the extent to which they influence the teaching effectiveness of those responding is not attempted in the report.

Because of the danger of reducing the usefulness of an already lengthy questionnaire, no attempt was made to uncover some other important factors which tend to influence the quality of teaching by the teacher of science. One of these is the availability of a well-appointed laboratory. Similarly, no attempt was made to determine the level of student ability in the schools from which the sample of teachers was taken.

Response to the Questionnaire

The final questionnaire (reproduced in appendix B) was mailed to each of the 3,957 teachers in the sample on March 20, 1961. Subsequently, three followup procedures were directed to nonrespondents. The first two utilized additional questionnaires, accompanying letters, and return envelopes. These followup mailings were initiated on April 10 and April 24. The third followup was carried out with the cooperation of State directors of teacher education and certification throughout the country.[3] On May 8, these officials were sent packages containing (a) additional copies of the questionnaire, (b) return envelopes addressed to the director of the study, (c) a list of nonrespondents in their States, and (d) a suggested letter to nonresponding teachers to be sent on the letterhead and over the signature of the State directors.

The cutoff date, at which time processing of questionnaire returns was begun, was July 31, 1961. At that time, usable responses had been received from 3,012 teachers, or 76 percent of the original sample. The numbers and percentages of usable questionnaires by geographical region are shown in the following table:

Teachers in sample	All regions	North-east	South	North Central	West
Total	3,957	940	1,083	1,315	615
Respondents	3,012	709	790	1,048	469
Percent respondents	76	75	73	80	75

Of some significance in the interpretation of frequencies obtained in the survey is the response rate from schools of differing size. Without

[3] Except in Michigan, where Dr. T. Wayne Taylor, Michigan State University, East Lansing, carried out the followup.

specifying grade levels within schools, the response rates in some of the school-size categories were as follows:

School enrollment	Questionnaires sent	Questionnaires returned	Percent returned
Total	3,957	3,012	76
Under 100	140	92	66
100-199	290	217	75
200-299	320	238	74
300-499	549	422	77
500-999	1,179	918	77
1,000-1,499	745	587	79
1,500 or more	734	538	73

It may be observed that the response rate, with the exception of that from teachers in schools of less than 100 pupils, was reasonably uniform over the school-size categories.

Charactistics of Nonresponding Teachers

In an effort to obtain some information about the 945 teachers who had not responded, the Western Union office in Washington, D.C., was asked to mail, on June 12, a directive containing five questions to each of its representatives in or near the localities of the nonrespondents. The five questions were:

(1) What mathematics and/or science subjects have you been teaching during the past school year?
(2) How many college hours of science and/or mathematics have you had?
(3) In what year(s) did you receive your degree?
(4) How long have you been teaching science and/or mathematics?
(5) Have you ever completed a program or institute offered by the National Science Foundation?

The Western Union representative then telephoned the teacher named, recorded the answers, and forwarded the completed information to the Washington Western Union office. This survey of nonrespondents was carried out before the analysis of the data from returned questionnaires was completed. Relevant information was obtained from 452, or 48 percent, of the nonrespondents.

Question 1 was used to categorize the sample of nonrespondents as science teachers, mathematics teachers, or science-and-mathematics teachers. The following table compares the distribution of respondents and the sample of nonrespondents by subject area:

Teachers in sample	Total	Science	Mathematics	Science and mathematics
Respondents:				
Number	3,012	1,230	1,280	502
Percent	100	41	42	17
Nonrespondents:				
Number	452	178	196	78
Percent	100	40	43	17

Although question 2 was not directly comparable with data analyzed for the responding teachers, the following tabulation suggests that lower levels of science and mathematics preparation may characterize the nonresponding teachers:

Sample of nonrespondents	Total	College hours in science and mathematics			
		Less than 9	9-17	18-29	30 or more
Number	452	218	61	53	120
Percent	100	48	13	12	27

The fact that 48 percent of the sample of nonrespondents had less than 9 semester hours in science and mathematics indicates a lower level of preparation for this group as a whole than for respondent teachers in any of the subject-matter areas reported in the main part of the study (see tables 17, 22, 27, 32, 37, and 42).

Question 3 did not specify level of degree (associate, bachelor's, master's, doctor's), but most of the teachers reached by Western Union operators gave information concerning all their degrees. The following table compares respondents and the sample of nonrespondents according to highest earned degree reported:

Teachers in sample	Total	Highest degree				
		Associate	Bachelor's	Master's	Doctor's	No response
Respondents:						
Number	3,012	39	1,743	1,149	18	63
Percent	100	1	58	38	1	2
Nonrespondents:						
Number	452	----	313	105	1	33
Percent	100	----	70	23	(1)	7

[1] Insignificant.

It was intended that question 4, dealing with years of experience in teaching science or mathematics, should provide data that could be compared with that produced by question VIII—the three-part question on teaching experience in the full-scale questionnaire (appendix B). However, the three-part question proved to be difficult or confusing for respondents, and 616 of them—20 percent of the sample of 3,012—either did not answer it completely or answered it in ways that appeared to be self-contradictory. This question was therefore subsequently dropped from the analysis. Only 10 (2 percent) of the sample of nonrespondents failed to give a codable response to question 4. Of the teachers who answered VIII–b in the questionnaire ("years of teaching experience: science subjects"), 49 percent reported less than 10 years experience. Of those who answered VIII–c ("years of teaching experience: mathematics"), 46 percent reported less than 10 years. Of the teachers in the nonrespondent sample who answered question 4 ("How long have you been teaching science and/or mathematics?"), 48 percent reported less than 10 years experience.

Answers to question 5 show that teachers in the sample of nonrespondents were less likely than the respondent sample to have participated in the National Science Foundation programs.

Teachers in sample	Total	Participation in NSF program		
		Yes	No	No response
Respondents:				
Number	3,012	794	2,106	112
Percent	100	26	70	4
Nonrespondents:				
Number	452	56	386	10
Percent	100	12	86	2

The general picture provided by this followup of nonresponding teachers suggests that they had somewhat less training, as a group, than the teachers who responded and upon whose responses the tabulations in the report are based. If these indications (based upon data for approximately one-half the nonresponding teachers) are reasonably correct, some degree of bias is present in the survey findings. This bias is of uncertain extent for the various tabulations, but the general effect is to make the findings of this study show a somewhat more favorable picture of teacher training and qualifications than would result if a response rate of 100 percent had been obtained. However, the actual response rate of 76 percent, and the size of the known differences between respondents and nonrespondents, suggests that the distortion is small.

APPENDIX B

SAMPLE QUESTIONNAIRE

Study of the

Qualifications and Service Loads of Teachers of Secondary Science and Mathematics

American Association for the Advancement of Science

and the

National Association of State Directors of Teacher Education and Certification

1515 MASSACHUSETTS AVENUE, N. W. WASHINGTON 5, D. C.

March 20, 1961

TO: Teachers of Secondary Science and Mathematics

This questionnaire is the major instrument in a study being conducted for the National Science Foundation by NASDTEC and AAAS.

The primary purpose of the study is to provide the teachers themselves, educational authorities, and the public generally with a more adequate understanding of the present qualifications and service loads of teachers of secondary science and mathematics throughout the country. An important related purpose is to help the NSF and other organizations plan programs useful to teachers in these fields.

The questionnaire is being sent to a representative sample of all the science and mathematics teachers in the public and private secondary schools (grades 7 - 12) of the United States, including those who devote full time to these subjects and also those who may teach a single class in them. The basic list from which your name was taken was supplied by the National Science Teachers Association and the National Council of Teachers of Mathematics. Selection of a mailing list for the questionnaire has been made on a completely random basis.

The selection of your name is in no way related to any application you may have filed for National Science Foundation institutes or fellowships nor to your possible past participation in those institutes. No identification of individuals or schools will be made in the report. Names are included only for follow-up purposes and in order to relate information about individuals to the type of school in which they are teaching.

Your response is important. Accurate results will be achieved only if we have replies from everyone in the selected sample.

We are grateful for your help and urge you to complete the questionnaire and return it in the enclosed self-addressed envelope as soon as possible.

Very truly yours,

William P. Viall

William P. Viall
Director

Study of the

QUALIFICATIONS AND SERVICE LOADS OF TEACHERS OF SECONDARY SCIENCE AND MATHEMATICS

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

and the

NATIONAL ASSOCIATION OF STATE DIRECTORS OF TEACHER EDUCATION AND CERTIFICATION

1515 Massachusetts Avenue, N. W.
Washington 5, D. C.

GENERAL DIRECTIONS

1. Please read the questionnaire through carefully before you answer any questions.
2. In the interest of accuracy, referral to your college or university transcripts is suggested.
3. When you have completed the questionnaire, please place it in the enclosed self-addressed envelope and mail.

I. Name of school where you teach_____

II. Location of school_____
(CITY OR POST OFFICE) (ZONE) (STATE)

III. Check type of school: (a) Public ☐ (b) Sectarian Private ☐ (c) NonSectarian ☐

IV. Circle *all* grades in school: K 1 2 3 4 5 6 7 8 9 10 11 12 13 14

V. Your name:_____
(FIRST) (MIDDLE) (LAST)

VI. Male ____ Female ____ VII. Age: (a) Under 25____ (b) 25-34____ (c) 35-44____ (d) 45 or over ____

VIII. Please indicate total number of years of teaching experience: (Teaching experience in subject may be concurrent.)

(a) All subjects_____ (b) Science subjects_____ (c) Mathematics subjects_____

IX. Please list below all subjects or courses you are teaching at present, and fill in related information.

(A) Grade Level	(B) Number of Classes	(C) Average Class Size	(D) Class Periods Per Week		(E) Length of Class Period		(F) Years You Have Taught Subject
			Lecture	Lab.	Lecture	Lab.	
1. SCIENCE SUBJECTS							
2. MATHEMATICS SUBJECTS							
3. OTHER SUBJECTS							

677748—63——4

X. Based on your work load for the previous week, please estimate the number of hours per week and the percentages of time that you spend on the following school activities:

	(A) HOURS PER WEEK	(B) PERCENTAGE OF TIME
1. Teaching time, classroom and laboratory, as described in question IX.		%
2. Teaching related school activities (such as class preparation, correcting papers, record keeping, coaching, band, dramatics, supervision of study hall and assisting in administrative or supervisory work, etc).		%
3. Other school activities (such as lunch room supervision, ticket taker, bus duty, class sponsorship, etc.).		%
	Total Hours	Total—100%

XI-A. Please indicate the year(s) you received the degree or degree(s) you now hold, place *the year(s)* in the degree column(s) (A, B, C, and/or D) after appropriate type of institution.

TYPE OF INSTITUTION	(A) Associate Certificate Degree or Diploma *	(B) Bachelor's	(C) Master's	(D) Doctor's
1. Teachers college				
2. Liberal Arts college				
3. College (or school) of education in a university				
4. Other college (or school) in a university				
5. Normal school				
6. Junior college				
7. Specify other type of higher education institution				

* Less than a four-year terminal program.

XI-B. Please indicate number of semester hours you have earned in excess of number required for highest earned degree _____ (To change quarter hour into semester hours multiply by 2/3.)

XII-A. On page 3 (opposite page). Please report the number of semester hours you earned in each subject listed in the appropriate column. (To change quarter hours into semester hours multiply by 2/3.) Categories 1-6 apply directly to specific content in science and mathematics, and 7 applies to professional education.

The code should be used for completing the columns pertaining to the year in which the course was taken. Where code symbols overlap, such as years 1956-1957, use code for last year only, i.e. 1957=Z.

Code	
Calendar Year Taken	Symbol
Before 1940	W
1940-1949	X
1950-1956	Y
1957 or later	Z

XII-A. See directions at bottom of page 2

	(A) UNDERGRADUATE Number Sem. Hrs.	(B) UNDERGRADUATE Year Taken	(C) GRADUATE Number Sem. Hrs.	(D) GRADUATE Year Taken
1. BIOLOGICAL SCIENCES				
(A) Introductory Biology (General Biology, General Botany, General Zoology)				
(B) Environmental Biology (Ecology, Conservation, Natural Biology)				
(C) Physiological Biology (General, Plant, Comparative, Biophysics, Systematic)				
(D) Morphological Biology (Comparative, Plant, Animal, Developmental)				
(E) Genetics and Evolution				
(F) Microbiology (including Bacteriology)				
(G) Other (do not specify)				
(H) Total Hours)				
2. CHEMISTRY				
(A) General Chemistry				
(B) Analytical Chemistry				
(C) Energy and Matter				
(D) Physical Chemistry				
(E) Other (do not specify)				
(F) Total Hours				
3. BIOCHEMISTRY (Total Hours in Biochemistry)				
4. PHYSICS				
(A) Introductory General Physics				
(B) Mechanics				
(C) Energy and Matter				
(D) Optics				
(E) Heat and Thermodynamics				
(F) Modern Physics				
(G) Other (do not specify)				
(H) Total Hours				
5. EARTH SCIENCES				
(A) Astronomy				
(B) Meteorology				
(C) Physical Geography				
(D) Geology—Geophysics				
(E) Other (do not specify)				
(F) Total Hours				
6. MATHEMATICS				
(A) Mathematics, prerequisite to calculus				
(B) Calculus, including advanced calculus and differential equations				
(C) Geometry, not including the first course in analytical geometry				
(D) Algebra, including theory of equations and modern algebra, but not precalculus algebra				
(E) Probability and mathematical statistics				
(F) Other (do not specify)				
(G) Total Hours				
7. PROFESSIONAL EDUCATION				
(A) Methods of Teaching Science				
(B) Methods of Teaching Mathematics				
(C) Student Practice Teaching, Science				
(D) Student Practice Teaching, Mathematics				
(E) Methods of Teaching, other than science or mathematics				
(F) Student Practice Teaching, other than science or mathematics				
(G) Other (do not specify)				
(H) Total Hours				

XII-B. If there are courses listed in XII-A which you have not taken but desire to take, please list by *number*, (i.e. Environmental Biology by using I-B). _____ _____ _____ _____ _____ _____ _____

_____ _____ _____ _____ _____ _____ _____ _____ _____ _____

XIII. Please indicate by use of the appropriate symbol in the following code your participation in National Science Foundation Institutes or fellowship supported programs, or similar formal programs in science and/or mathematics.

CODE	
NSF programs, applied to one or more but not accepted by any	W
NSF programs, applied to one or more, accepted by at least one, but did not attend or successfully complete	X
NSF programs successfully completed	Y
Other programs successfully completed	Z

Note: If you did not apply for any of these programs check √ here ☐ and go on to question XIV.

A. ACADEMIC YEAR INSTITUTES AND COURSES

A. Do not include any providing less than 30 clock hours of instructions and/or laboratory.

	(A) 1955/6	(B) 1956/7	(C) 1957/8	(D) 1958/9	(E) 1959/60	(F) 1960/1
1. NSF Academic Year Institute						
2. NSF In-Service Institute						
3. State Sponsored Institute or Course						
4. Local School System Sponsored Institute or Course						
5. Institutes or Courses under Other Sponsorship (Industrial, etc.)						

B. SUMMER INSTITUTES AND COURSES

B. Do not include any programs less than four weeks' duration on a full-time basis.

	(A) 1955	(B) 1956	(C) 1957	(D) 1958	(E) 1959	(F) 1960
1. NSF Summer Institute						
2. NSF Summer Participation Program						
3. State Sponsored Institute or Course						
4. Local School System Sponsored Institute or Course						
5. Institutes or Courses under Other Sponsorship (Industrial, etc.)						

C. FELLOWSHIPS

C. Do not include stipends received for programs attended under A or B.

	(A) 1955	(B) 1956	(C) 1957	(D) 1958	(E) 1959	(F) 1960
1. NSF Summer Fellowship						
2. State Sponsored Fellowship						
3. Local School System Sponsored Fellowship						
4. Fellowship under Other Sponsorship (Industrial, etc.)						

XIV. The information requested here will be used only for statistical purposes and will not in any way be associated with any teacher's name or with any particular school system. In order to help us arrive at a country-wide estimate of salaries of teachers of secondary science and mathematics, please place a check V below for the range in which your salary for the *1960-61* school year falls:

1. ☐ under $3,000	9. ☐ $6,500-$6,999
2. ☐ $3,000- 3,499	10. ☐ 7,000- 7,499
3. ☐ 3,500- 3,999	11. ☐ 7,500- 7,999
4. ☐ 4,000- 4,499	12. ☐ 8,000- 8,499
5. ☐ 4,500- 4,999	13. ☐ 8,500- 8,999
6. ☐ 5,000- 5,499	14. ☐ 9,000- 9,499
7. ☐ 5,500- 5,999	15. ☐ 9,500- 9,999
8. ☐ 6,000- 6,499	16. ☐ 10,000 or more

XV. If there are any activities in which you have participated that have contributed to your ability as a teacher, please describe briefly:

Budget Bureau #99-6102
Approval Expires September 1, 1961

APPENDIX C

TABLES

TABLE 1.—*Secondary school science and mathematics teachers, by region and by sex, spring 1961*

Sex	Teachers in sample					Teachers with one or more classes in—														
						Science					Mathematics					Science and mathematics				
	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West
Both sexes	3,012	709	790	1,048	465	1,230	317	296	449	168	1,280	293	356	427	204	502	99	138	172	93
Male	2,093	470	466	794	363	920	236	190	360	134	808	168	189	297	154	365	66	87	137	75
Female	919	239	324	254	102	310	81	106	89	34	472	125	167	130	50	137	33	51	35	18
Percent males	69	66	59	76	78	75	74	64	80	80	63	57	53	70	75	73	67	63	80	81

TABLE 2.—*Secondary school science and mathematics teachers, by region and by age, spring 1961*

Age	Teachers in sample					Teachers with one or more classes in—														
						Science					Mathematics					Science and mathematics				
	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West
All ages	3,012	709	790	1,048	465	1,230	317	296	449	168	1,280	293	356	427	204	502	99	138	172	93
Under 25	329	90	73	127	40	144	41	35	54	14	136	36	31	51	18	49	13	6	22	8
25-34	1,160	252	306	417	185	485	113	107	190	75	471	100	136	161	74	204	39	63	66	36
35-44	668	146	187	223	112	275	68	78	89	40	264	55	74	92	43	129	23	35	42	29
Over 44	841	218	221	275	127	321	94	74	114	39	401	100	113	120	68	119	24	34	41	20
Not reported	14	3	4	6	1	5	1	2	2	-------	8	2	2	3	1	1	-------	-------	1	-------
Percent under 35 [1]	50	48	48	52	48	51	49	48	55	53	48	47	47	50	45	50	53	50	51	47

[1] Computations exclude teachers who did not report age.

TABLE 3.—*Secondary school science and mathematics teachers, by region and by years of teaching experience, spring 1961*

Years teaching experience, any subject [1]	Teachers in sample					Teachers with one or more classes in—														
						Science					Mathematics					Science and mathematics				
	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West
All years	3,012	709	790	1,048	465	1,230	317	296	449	168	1,280	293	356	427	204	502	99	138	172	93
1–4	773	189	197	258	129	320	81	83	108	48	304	75	76	99	54	149	33	38	51	27
5–9	503	131	135	155	82	224	71	44	78	31	188	44	59	52	33	91	16	32	25	18
10–14	401	83	110	131	77	166	34	46	57	29	163	37	48	48	30	72	12	16	26	18
15–19	187	39	58	66	24	62	14	22	21	5	91	17	23	37	14	34	8	13	8	5
20–24	165	44	51	57	13	69	21	22	21	5	71	16	24	25	6	25	7	5	11	2
25–29	143	32	41	43	27	67	20	13	23	11	58	11	21	13	13	18	1	7	7	3
30 or more	224	70	48	80	26	88	32	14	35	7	101	27	27	32	15	35	11	7	13	4
Not reported	616	121	150	258	87	234	44	52	106	32	304	66	78	121	39	78	11	20	31	16
Percent under 10 years [2]	53	54	52	52	56	55	56	52	54	58	50	52	49	49	53	57	56	59	54	58

[1] Includes all teaching experience in nonscience as well as science and mathematics subjects.

[2] Computations exclude teachers who did not report years of teaching experience.

TABLE 4.—*Secondary school science and mathematics teachers, by region and by enrollment of school, spring 1961*

Enrollment size of school	Teachers in sample					Teachers with one or more classes in—														
						Science					Mathematics					Science and mathematics				
	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West
All enrollment sizes	3,012	709	790	1,048	465	1,230	317	296	449	168	1,280	293	356	427	204	502	99	138	172	93
Under 100	92	11	12	47	22	28	3	3	16	6	27	2	3	14	8	37	6	6	17	8
100–199	217	28	54	105	30	86	12	24	41	9	71	11	16	34	10	60	5	14	30	11
200–299	238	40	72	96	30	102	15	27	46	14	85	15	31	31	8	51	10	14	19	8
300–499	422	88	133	155	46	157	33	44	60	20	167	34	55	61	17	98	21	34	34	9
500–999	918	248	254	300	116	369	113	95	123	38	396	97	118	135	46	153	38	41	42	32
1,000–1,499	587	154	156	186	91	235	71	57	77	30	284	72	77	92	43	68	11	22	17	18
1,500 or more	538	140	109	159	130	253	70	46	86	51	250	62	56	60	72	35	8	7	13	7
Percent under 500	32	24	34	38	28	30	20	33	36	29	27	21	29	33	21	49	42	49	58	39

TABLE 5.—*Secondary school science and mathematics teachers, by region and by type of school control, spring 1961*

Type of school control	Teachers in sample					Teachers with one or more classes in—														
						Science					Mathematics					Science and mathematics				
	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West
All types	3,012	709	790	1,048	465	1,230	317	296	449	168	1,280	293	356	427	204	502	99	138	172	93
Public	2,651	576	736	922	417	1,106	267	278	404	157	1,128	235	331	376	186	417	74	127	142	74
Private:																				
Sectarian	229	78	30	87	34	77	28	9	33	7	94	34	13	34	13	58	16	8	20	14
Nonsectarian	80	43	12	17	8	28	13	4	7	4	36	21	6	7	2	16	9	2	3	2
Not reported	52	12	12	22	6	19	9	5	5	0	22	3	6	10	3	11	0	1	7	3
Percent public control [1]	90	83	95	90	91	91	87	96	91	93	90	81	95	90	93	85	75	93	86	82

[1] Computations exclude teachers who did not report type of control.

TABLE 6.—*Secondary school science and mathematics teachers, by region and by grade levels within the school, spring 1961*

Grade levels within school	Teachers in sample					Teachers with one or more classes in—														
						Science					Mathematics					Science and mathematics				
	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West
All levels	3,012	709	790	1,048	465	1,230	317	296	449	168	1,280	293	356	427	204	502	99	138	172	93
1–12 [1]	514	79	171	225	39	192	34	56	90	12	183	29	63	79	12	139	16	52	56	15
7–9	479	111	123	138	107	176	45	45	58	28	238	50	60	66	62	65	16	18	14	17
7–12	349	134	106	91	18	134	52	38	35	9	155	60	52	39	4	60	22	16	17	5
9–12	691	183	105	259	144	299	91	41	119	48	299	75	53	106	65	93	17	11	34	31
10–12	346	75	90	98	83	150	37	33	36	44	162	31	51	50	30	34	7	6	12	9
Other	392	82	118	148	44	175	34	53	70	18	148	33	45	54	16	69	15	20	24	10
Not reported	241	45	77	89	30	104	24	30	41	9	95	15	32	33	15	42	6	15	15	6

[1] In some schools includes kindergarten.

TABLE 7.—*Average of estimated service loads of secondary school science and mathematics teachers, by region and by type of activity, spring 1961*

Type of activity [1]	Average hours per week, teachers in sample					Average hours per week, teachers with one or more classes in—														
						Science					Mathematics					Science and mathematics				
	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West
All school activities	44.8	42.1	45.5	46.4	46.1	44.8	41.1	45.8	46.2	46.0	44.8	41.6	44.7	46.9	45.6	44.5	43.1	43.9	47.5	47.3
Teaching time [2]	22.7	20.5	24.4	22.9	24.6	22.9	20.3	24.0	23.1	24.8	22.3	19.3	23.4	22.7	24.0	23.2	21.8	24.9	24.5	25.4
Teaching-related activities [3]	17.4	17.3	16.3	18.7	16.8	17.4	16.8	17.1	18.6	16.5	17.7	17.9	16.4	19.2	16.9	16.6	16.9	14.5	17.8	17.4
Other school activities [4]	4.7	4.3	4.8	4.8	4.7	4.5	4.0	4.7	4.5	4.7	4.8	4.4	4.9	5.0	4.7	4.7	4.4	4.5	5.2	4.5
Percent teaching time	51	49	54	49	53	51	49	52	50	54	50	46	52	48	53	52	51	57	52	54

[1] Averages represent hours in average workweek. Both average number of hours and percentages are based on estimates and are, therefore, approximate.

[2] Classroom and laboratory.

[3] Activities closely related to teaching (such as class preparation, correcting papers, recordkeeping, coaching, band, dramatics, supervision of study hall, and assisting in administrative or supervisory work).

[4] Lunchroom supervision, ticket taker, bus duty, class sponsorship, etc.

TABLE 8.—*Secondary school science and mathematics teachers, by region and by number of classes in science and mathematics, spring 1961*

Number of classes taught [1]	Teachers in sample					Teachers with one or more classes in—														
						Science					Mathematics					Science and mathematics				
	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West
Total	3,012	709	790	1,048	465	1,230	317	296	449	168	1,280	293	356	427	204	502	99	138	172	93
1 or 2	490	90	143	173	84	216	43	56	90	27	218	38	61	70	49	56	9	26	13	8
3 or 4	837	213	213	310	101	375	110	90	138	37	324	85	83	115	41	138	18	40	57	23
5 or more	1,685	406	434	565	280	639	164	150	221	104	738	170	212	242	114	308	72	72	102	62
Percent 5 or more	56	57	55	54	60	52	52	51	49	62	58	58	60	57	56	61	73	52	59	67

[1] Classes in science or mathematics.

TABLE 9.—*Secondary school science and mathematics teachers, by region and by salary range,[1] spring 1961*

Salary range	Teachers in sample					Teachers with one or more classes in—														
						Science					Mathematics					Science and mathematics				
	Total	Northeast	South	North Central	West	Total	Northeast	South	North Central	West	Total	Northeast	South	North Central	West	Total	Northeast	South	North Central	West
All salaries	3,012	709	790	1,048	465	1,230	317	296	449	168	1,280	293	356	427	204	502	99	138	172	93
Under $3,000	182	58	46	57	21	59	19	17	19	4	75	24	19	23	9	48	15	10	15	8
$3,000–$3,449	126	11	103	10	2	45	5	34	4	2	57	4	47	6	----	24	2	22	----	----
$3,500–$3,999	202	18	149	31	4	57	4	45	8	----	93	9	70	13	1	52	5	34	10	3
$4,000–$4,499	432	84	173	135	40	187	37	75	58	17	161	32	68	49	12	84	15	30	28	11
$4,500–$4,999	391	79	99	157	56	165	40	35	72	18	152	30	49	53	20	74	9	15	32	18
$5,000–$5,499	374	77	69	170	58	159	36	29	70	24	144	30	30	65	19	71	11	10	35	15
$5,500–$5,999	302	93	45	105	59	130	50	14	47	19	133	30	25	44	34	39	13	6	14	6
$6,000–$6,499	260	72	35	91	62	105	32	14	33	26	125	36	17	47	25	30	4	4	11	11
$6,500–$6,999	175	54	9	69	43	82	23	3	42	13	73	22	6	23	22	20	8	----	4	8
$7,000–$7,499	147	41	13	67	26	63	22	4	26	11	67	16	9	30	12	17	3	----	11	3
$7,500–$7,999	95	23	5	44	23	37	10	2	16	9	51	10	3	25	13	7	3	----	3	1
$8,000–$8,499	57	15	1	21	20	22	4	1	13	4	31	11	----	6	14	4	----	----	2	2
$8,500–$8,999	40	16	1	16	7	21	6	1	8	6	18	10	----	8	----	1	----	----	----	1
$9,000–$9,499	23	10	----	3	10	10	4	----	2	4	12	6	----	1	5	1	----	----	----	1
$9,500–$9,999	11	2	----	2	7	3	1	----	1	1	8	1	----	1	6	----	----	----	----	----
$10,000 or more	11	9	----	1	1	6	5	----	1	----	3	2	----	----	1	2	2	----	----	----
Not reported	184	47	42	69	26	79	18	22	29	10	77	20	13	33	11	28	9	7	7	5

[1] The boldface number in each column indicates the location of the median salary range for that column (exclusive of nonresponding teachers). Table based on 1960–61 salary without reference to length of school year.

TABLE 10.—*Secondary school science and mathematics teachers, by region and by highest earned degree, spring 1961*

Educational level, highest degree	Teachers in sample					Teachers with one or more classes in—														
						Science					Mathematics					Science and mathematics				
	Total	Northeast	South	North Central	West	Total	Northeast	South	North Central	West	Total	Northeast	South	North Central	West	Total	Northeast	South	North Central	West
All levels	3,012	709	790	1,048	465	1,230	317	296	449	168	1,280	293	356	427	204	502	99	138	172	93
Associate	39	11	13	13	2	11	2	5	3	1	19	7	5	6	1	9	2	3	4	----
Bachelor's	1,743	363	505	609	266	691	152	184	233	92	745	159	226	245	115	307	52	95	101	59
Master's	1,149	309	247	405	188	499	151	100	177	71	479	118	111	166	84	171	40	36	62	33
Doctorate	18	10	1	4	3	9	6	1	1	1	9	4	----	3	2	----	----	----	----	----
Not reported	63	16	24	17	6	20	6	6	5	3	28	5	14	7	2	15	5	4	5	1
Percent master's[1]	39	45	32	39	41	41	49	34	40	43	38	41	32	40	42	35	43	27	37	36

[1] Computations exclude teachers who did not report highest degree.

TABLE 11.—*Secondary school science and mathematics teachers, by region, highest degree, and excess hours of credit, spring 1961*

Highest degree and excess hours [1]	Teachers in sample [2]					Teachers with one or more classes in—														
						Science					Mathematics					Science and mathematics				
	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West
Bachelor's degree highest	1,743	363	505	609	266	691	152	184	263	92	745	159	226	245	115	307	52	95	101	59
Excess hours:																				
Less than 10	672	130	232	252	58	253	43	81	113	16	303	62	112	97	32	116	25	39	42	10
10–29	638	158	191	218	71	253	70	75	84	24	269	66	80	99	24	116	22	36	35	23
30 or more	433	75	82	139	137	185	39	28	66	52	173	31	34	49	59	75	5	20	24	26
Percent 10 or more excess hours	61	64	54	59	78	63	72	56	57	83	59	61	50	60	72	62	52	59	58	83
Master's degree highest	1,149	309	247	405	188	499	151	100	177	71	479	118	111	166	84	171	40	36	62	33
Excess hours:																				
Less than 10	532	131	149	193	59	228	72	58	81	17	231	40	71	91	29	73	19	20	21	13
10–29	379	110	72	129	68	162	46	30	58	28	157	49	31	47	30	60	15	11	24	10
30 or more	238	68	26	83	61	109	33	12	38	26	91	29	9	28	25	38	6	5	17	10
Percent 10 or more excess hours	54	58	40	52	69	54	52	42	54	76	52	66	36	45	65	57	52	44	66	61

[1] Semester hours in any course taken for credit after attaining the degree.

[2] Excludes teachers who reported the associate or the doctoral degree as highest or did not report degree.

TABLE 12.—*Secondary school science and mathematics teachers, by region and by type of institution conferring bachelor's degree, spring 1961*

Type of institution conferring bachelor's degree	Teachers in sample					Teachers with one or more classes in—														
						Science					Mathematics					Science and mathematics				
	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West
All types	3,012	709	790	1,048	465	1,230	317	296	449	168	1,280	293	356	427	204	502	99	138	172	93
Teachers college	533	192	237	309	95	317	82	94	108	33	370	79	107	143	41	146	31	36	58	21
Liberal arts college	1,141	317	301	363	160	459	146	100	154	59	481	132	136	147	66	201	39	65	62	35
College or school of education in a university	573	93	136	233	111	249	42	54	113	40	247	40	61	91	55	77	11	21	29	16
Other college or school in a university	327	74	71	102	80	158	37	33	60	28	120	27	30	29	34	49	10	8	13	18
Other type	24	4	3	8	9	9	1	1	4	3	10	2	1	3	4	5	1	1	1	2
Not reported	114	29	42	33	10	38	9	14	10	5	52	13	21	14	4	24	7	7	9	1
Percent teachers college [1]	29	28	32	30	21	27	27	33	25	20	30	28	32	35	20	31	34	27	36	23

[1] Computations exclude teachers who either did not report having bachelor's degree or did not report type of institution.

TABLE 13.—*Secondary school science and mathematics teachers, by region and by year of bachelor's degree, spring 1961*

Year of bachelor's degree	Teachers in sample					Teachers with one or more classes in—														
						Science					Mathematics					Science and mathematics				
	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West
All years	3,012	709	790	1,048	465	1,230	317	296	449	168	1,280	293	356	427	204	502	99	138	172	93
Before 1940	708	191	176	237	104	275	86	59	98	32	338	87	91	105	55	95	18	26	34	17
1940–1949	524	130	142	166	86	219	62	53	70	34	224	52	60	75	37	81	16	29	21	15
1950–1956	898	196	241	315	146	381	93	87	142	59	360	75	108	119	58	157	28	46	54	29
1957–1961	768	163	189	297	119	317	67	83	129	38	306	66	76	114	50	145	30	30	54	31
Not reported	114	29	42	33	10	38	9	14	10	5	52	13	21	14	4	24	7	7	9	1
Percent since 1950[1]	57	53	57	60	58	59	52	60	62	60	54	50	55	56	54	63	63	58	66	65

[1] Computations exclude teachers who did not report year of bachelor's degree.

TABLE 14.—*Secondary school science and mathematics teachers, by region and by participation in National Science Foundation summer institutes, spring 1961*

Participation in summer institute	Teachers in sample					Teachers with one or more classes in—														
						Science					Mathematics					Science and mathematics				
	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West	Total	North-east	South	North Central	West
Total	3,012	709	790	1,048	465	1,230	317	296	449	168	1,280	293	356	427	204	502	99	138	172	93
Completed at least one institute	606	133	147	223	103	270	58	62	102	48	229	53	59	82	35	107	22	26	39	20
Did not complete an institute[1]	2,406	576	643	825	362	960	259	234	347	120	1,051	240	297	345	169	395	77	112	133	73
Percent who completed	20	19	19	21	22	22	18	21	23	29	18	18	17	19	17	21	22	19	23	22

[1] Includes those who did not report, indicated application but were not accepted, or participated but did not successfully complete a National Science Foundation summer institute.

TABLE 15.—*Secondary school general science teachers, by number of classes in general science, by region, and by highest degree, spring 1961*

Educational level, by highest degree	General science teachers							
	Total	By number of general science classes			By region			
		1–2	3–4	5 or more	North-east	South	North Central	West
All levels	1,008	495	245	268	221	292	364	131
Associate	14	7	3	4	4	4	5	1
Bachelor's	644	327	159	158	128	194	236	86
Master's	319	144	75	100	80	86	112	41
Doctorate	2	1	1	----------	1	1	----------	----------
Not reported	29	16	7	6	8	7	11	3
Percent master's [1]	33	30	32	38	38	30	32	32

[1] Computations exclude teachers who did not report highest degree.

TABLE 16.—*Secondary school general science teachers, by number of classes in general science, by region, and by highest degree and excess hours of credit, spring 1961*

Highest degree and excess hours [1]	General science teachers [2]							
	Total	By number of general science classes			By region			
		1–2	3–4	5 or more	North-east	South	North Central	West
Bachelor's degree highest	644	327	159	158	128	194	236	86
Excess hours:								
Less than 10	246	134	63	49	43	86	102	15
10–29	254	127	59	68	57	83	83	31
30 or more	144	66	37	41	28	25	51	40
Percent 10 or more excess hours	62	59	60	69	66	56	57	83
Master's degree highest	319	144	75	100	80	86	112	41
Excess hours:								
Less than 10	165	74	40	51	44	54	56	11
10–29	91	45	18	28	21	24	32	14
30 or more	63	25	17	21	15	8	24	16
Percent 10 or more excess hours	48	49	47	49	45	37	50	73

[1] Semester hours in any course taken for credit after attaining the degree.

[2] Excludes teachers who reported the associate or the doctoral degree as highest or did not report degree.

TABLE 17.—*Secondary school general science teachers, by number of classes in general science, by region, and by hours of credit in biology and chemistry, spring 1961*

Undergraduate or graduate semester hours in biology and chemistry	General science teachers							
	Total	By number of general science classes			By region			
		1-2	3-4	5 or more	North-east	South	North Central	West
Total	1,008	495	245	268	221	292	364	131
Less than 9 hours in biology:								
Total	344	202	72	70	82	107	114	41
Chemistry less than 9 hours	232	135	48	49	61	82	76	23
Chemistry 9 or more hours	112	67	24	21	21	25	38	18
9-17 hours in biology:								
Total	207	101	43	63	42	71	70	24
Chemistry less than 9 hours	119	54	31	34	19	44	41	15
Chemistry 9 or more hours	88	47	12	29	23	27	29	9
18-29 hours in biology:								
Total	194	81	56	57	38	66	69	21
Chemistry less than 9 hours	110	33	39	38	22	36	39	13
Chemistry 9 or more hours	84	48	17	19	16	30	30	8
30 or more hours in biology:								
Total	263	111	74	78	59	48	111	45
Chemistry less than 9 hours	101	45	25	31	23	19	41	18
Chemistry 9 or more hours	162	66	49	47	36	29	70	27
Percent with at least 30 hours in biology	26	22	30	29	27	16	30	34

TABLE 18.—*Secondary school general science teachers, by number of classes in general science, by year of most recent graduate study in biology, and by year of bachelor's degree, spring 1961*

Year of bachelor's degree	General science teachers, by year of most recent graduate study in biology [1]																	
	All teachers of general science in sample						Teachers with 1 or 2 classes in general science						Teachers with 3 or more classes in general science					
	Total	Before 1940	1940-49	1950-56	1957 or later	None [2]	Total	Before 1940	1940-49	1950-56	1957 or later	None [2]	Total	Before 1940	1940-49	1950-56	1957 or later	None [2]
All years	1,008	13	10	42	173	770	495	6	6	17	68	398	513	7	4	25	105	372
Before 1940	161	13	5	7	17	119	78	6	1	3	9	59	83	7	4	4	8	60
1940-49	173	-------	4	18	31	120	80	-------	4	6	9	61	93	-------	-------	12	22	59
1950-56	321	-------	-------	17	69	235	164	-------	-------	8	27	129	157	-------	-------	9	42	106
1957 or later	308	-------	-------	-------	53	255	149	-------	-------	-------	21	128	159	-------	-------	-------	32	127
Not reported	45	-------	1	-------	3	41	24	-------	1	-------	2	21	21	-------	-------	-------	1	20

[1] Any biology course taken for credit after attaining the bachelor's degree.
[2] No graduate study in biology reported.

TABLE 19.—*Secondary school general science teachers, by number of classes in general science, by region, and by other science classes, spring, 1961*

Other science classes [1]	General science teachers							
	Total	By number of general science classes			By region			
		1–2	3–4	5 or more	North-east	South	North Central	West
Total	1,008	495	245	268	221	292	364	131
Mathematics 9–12	85	49	31	5	19	24	27	15
Mathematics 7–8	149	95	44	10	25	55	45	24
Mathematics 7–8 and 9–12	32	26	5	1	8	11	7	6
Biology	186	134	42	10	38	52	81	15
Biology and mathematics 9–12	25	22	2	1	3	8	7	7
Biology and mathematics 7–8	8	5	2	1	----------	3	3	2
Biology and mathematics 7–8 and 9–12	4	2	1	1	----------	1	2	1
No mathematics or biology classes	519	162	118	239	128	138	192	61

[1] Only the three most frequently reported subjects are tabulated.

NOTE.—The entries are not cumulative; e.g., teachers reporting two subjects are counted only in the line specifying both those subjects. The total number of general science teachers with classes in mathematics 9–12 is 146; mathematics 7–8, 193; biology, 223. (For the number with classes in chemistry, see table 29; in physics, see table 34.)

TABLE 20.—*Secondary school biology teachers, by number of classes in biology, by region, and by highest degree, spring 1961*

Educational level, by highest degree	Biology teachers							
	Total	By number of biology classes			By region			
		1–2	3–4	5 or more	North-east	South	North Central	West
All levels	562	297	182	83	124	142	212	84
Associate	6	3	2	1	----------	5	1	----------
Bachelor's	339	199	99	41	70	97	122	50
Master's	210	89	80	41	54	37	86	33
Doctorate	2	2	----------	----------	----------	----------	1	1
Not reported	5	4	1	----------	----------	3	2	----------
Percent master's [1]	38	30	44	49	44	27	41	39

[1] Computations exclude teachers who did not report highest degree.

TABLE 21.—*Secondary school biology teachers, by number of classes in biology, by region, and by highest degree and excess hours of credit, spring 1961*

Highest degree and excess hours [1]	Biology teachers [2]							
	Total	By number of biology classes			By region			
		1-2	3-4	5 or more	North-east	South	North Central	West
Bachelor's degree highest	339	199	99	41	70	97	122	50
Excess hours:								
Less than 10	126	79	35	12	23	38	57	8
10-29	120	65	35	20	31	42	34	13
30 or more	93	55	29	9	16	17	31	29
Percent 10 or more excess hours	63	60	65	71	67	61	53	84
Master's degree highest	210	89	80	41	54	37	86	33
Excess hours:								
Less than 10	102	38	39	25	28	23	40	11
10-29	63	31	24	8	14	11	29	9
30 or more	45	20	17	8	12	3	17	13
Percent 10 or more excess hours	51	57	51	39	48	38	53	67

[1] Semester hours in any course taken for credit after attaining the degree.

[2] Excludes teachers who reported the associate or the doctoral degree as highest or did not report degree.

TABLE 22.—*Secondary school biology teachers, by number of classes in biology, by region, and by hours of credit in biology and chemistry, spring 1961*

Undergraduate or graduate semester hours in biology and chemistry	Biology teachers							
	Total	By number of biology classes			By region			
		1-2	3-4	5 or more	North-east	South	North Central	West
Total	562	297	182	83	124	142	212	84
Less than 9 hours in biology:								
Total	60	46	10	4	7	21	18	14
Chemistry less than 9 hours	43	31	9	3	5	16	12	10
Chemistry 9 hours of more	17	15	1	1	2	5	6	4
9-17 hours in biology:								
Total	91	65	20	6	27	26	29	9
Chemistry less than 9 hours	46	32	12	2	11	15	16	4
Chemistry 9 or more hours	45	33	8	4	16	11	13	5
18-29 hours in biology:								
Total	126	70	37	19	26	46	42	12
Chemistry less than 9 hours	66	30	23	13	17	24	18	7
Chemistry 9 hours or more	60	40	14	6	9	22	24	5
30 or more hours in biology:								
Total	285	116	115	54	64	49	123	49
Chemistry less than 9 hours	108	36	46	26	20	24	48	16
Chemistry 9 hours or more	177	80	69	28	44	25	75	33
Percent with at least 30 hours in biology	51	39	63	65	52	35	58	58

TABLE 23.—*Secondary school biology teachers, by number of classes in biology, by year of most recent graduate study in biology, and by year of bachelor's degree, spring 1961*

Year of bachelor's degree	Biology teachers, by year of most recent graduate study in biology [1]																	
	All teachers of biology in sample						Teachers with 1 or 2 classes in biology						Teachers with 3 or more classes in biology					
	Total	Before 1940	1940–49	1950–56	1957 or later	None [2]	Total	Before 1940	1940–49	1950–56	1957 or later	None [2]	Total	Before 1940	1940–49	1950–56	1957 or later	None [2]
All years	562	14	22	39	163	324	297	5	9	18	71	194	265	9	13	21	92	130
Before 1940	116	14	10	11	24	57	60	5	4	5	11	35	56	9	6	6	13	22
1940–49	84	-------	11	12	19	42	36	-------	5	3	8	20	48	-------	6	9	11	22
1950–56	185	-------	-------	16	72	97	100	-------	-------	10	31	59	85	-------	-------	6	41	38
1957 or later	164	-------	-------	-------	48	116	94	-------	-------	-------	21	73	70	-------	-------	-------	27	43
Not reported	13	-------	1	-------	-------	12	7	-------	-------	-------	-------	7	6	-------	1	-------	-------	5

[1] Any biology course taken for credit after attaining the bachelor's degree.
[2] No graduate study in biology reported.

TABLE 24.—*Secondary school biology teachers, by number of classes in biology, by region, and by other science classes, spring 1961*

Other science classes [1]	Biology teachers							
	Total	By number of biology classes			By region			
		1–2	3–4	5 or more	Northeast	South	North Central	West
Total	562	297	182	83	124	142	212	84
Physics	20	12	7	1	7	5	6	2
Chemistry	42	28	14	----------	10	8	15	9
Chemistry and physics	21	15	6	----------	6	6	5	4
General science	140	91	46	3	30	41	57	12
General science and physics	18	15	3	----------	6	3	8	1
General science and chemistry	40	35	4	1	4	13	16	7
General science, chemistry, and physics	25	25	----------	----------	1	7	12	5
No classes in physics, chemistry, or general science	256	76	102	78	60	59	93	44

[1] Only the three most frequently reported subjects are tabulated.

NOTE.—The entries are not cumulative; e.g., teachers reporting two subjects are counted only in the line specifying both those subjects. The total number of biology teachers with classes in physics is 84; in chemistry, 128; in general science, 223. (For the number with classes in mathematics 7–8 see table 39.)

TABLE 25.—*Secondary school chemistry teachers, by number of classes in chemistry, by region, and by highest degree, spring 1961*

Educational level, by highest degree	Chemistry teachers							
	Total	By number of chemistry classes			By region			
		1–2	3–4	5 or more	Northeast	South	North Central	West
All levels	401	272	103	26	104	90	142	65
Associate	1	----------	1	----------	----------	1	----------	----------
Bachelor's	219	163	47	9	44	54	84	37
Master's	173	102	54	17	55	35	56	27
Doctorate	5	5	----------	----------	3	----------	1	1
Not reported	3	2	1	----------	2	----------	1	----------
Percent master's [1]	43	38	53	65	54	39	40	42

[1] Computations exclude teachers who did not report highest degree.

TABLE 26.—*Secondary school chemistry teachers, by number of classes in chemistry, by region, and by highest degree and excess hours of credit, spring 1961*

Highest degree and excess semester hours [1]	Chemistry teachers [2]							
	Total	By number of chemistry classes			By region			
		1-2	3-4	5 or more	North-east	South	North Central	West
Bachelor's degree highest	219	163	47	9	44	54	84	37
Excess hours:								
Less than 10	75	59	12	4	16	19	32	8
10-29	62	46	13	3	16	21	20	5
30 or more	82	58	22	2	12	14	32	24
Percent 10 or more excess hours	66	64	74	56	64	65	62	78
Master's degree highest	173	102	54	17	55	35	56	27
Excess hours:								
Less than 10	54	33	17.	4	23	13	15	3
10-29	64	37	19	8	17	12	23	12
30 or more	55	32	18	5	15	10	18	12
Percent 10 or more excess hours	69	68	69	76	58	63	73	89

[1] Semester hours in any course taken for credit after attaining the degree.

[2] Excludes teachers who reported the associate or the doctoral degree as highest or did not report degree.

TABLE 27.—*Secondary school chemistry teachers, by number of classes in chemistry, by region, and by hours of credit in chemistry and mathematics, spring 1961*

Undergraduate or graduate semester hours in chemistry and mathematics	Chemistry teachers							
	Total	By number of chemistry classes			By region			
		1-2	3-4	5 or more	North-east	South	North Central	West
Total	401	272	103	26	104	90	142	65
Less than 9 hours in chemistry:								
Total	64	54	6	4	17	17	21	9
Mathematics less than 9 hours	44	35	5	4	12	12	14	6
Mathematics 9 hours or more	20	19	1	----	5	5	7	3
9-17 hours in chemistry:								
Total	94	78	14	2	18	21	40	15
Mathematics less than 9 hours	33	28	5	----	5	10	12	6
Mathematics 9 hours or more	61	50	9	2	13	11	28	9
18-29 hours in chemistry:								
Total	126	81	36	9	35	32	41	18
Mathematics less than 9 hours	41	24	13	4	12	12	8	9
Mathematics 9 hours or more	85	57	23	5	23	20	33	9
30 or more hours in chemistry:								
Total	117	59	47	11	34	20	40	23
Mathematics less than 9 hours	14	7	5	2	2	2	6	4
Mathematics 9 hours or more	103	52	42	9	32	18	34	19
Percent with at least 30 hours in chemistry	29	22	46	42	33	22	28	35

TABLE 28.—*Secondary school chemistry teachers, by number of classes in chemistry, by year of most recent graduate study in chemistry, and by year of bachelor's degree, spring 1961*

Year of bachelor's degree	Chemistry teachers, by year of most recent graduate study in chemistry [1]																	
	All teachers of chemistry in sample						Teachers with 1 or 2 classes in chemistry						Teachers with 3 or more classes in chemistry					
	Total	Before 1940	1940–49	1950–56	1957 or later	None [2]	Total	Before 1940	1940–49	1950–56	1957 or later	None [2]	Total	Before 1940	1940–49	1950–56	1957 or later	None [2]
All years	401	13	6	16	112	254	272	7	6	10	65	184	129	6	----	6	47	70
Before 1940	115	13	5	3	23	71	72	7	5	3	11	46	43	6	----	----	12	25
1940–49	62	----	1	6	23	32	42	----	1	2	14	25	20	----	----	4	9	7
1950–56	120	----	----	7	43	70	82	----	----	5	25	52	38	----	----	2	18	18
1957 or later	97	----	----	----	22	75	73	----	----	----	15	58	24	----	----	----	7	17
Not reported	7	----	----	----	1	6	3	----	----	----	----	3	4	----	----	----	1	3

[1] Any chemistry course taken for credit after attaining the bachelor's degree.
[2] No graduate study in chemistry reported.

TABLE 29.—*Secondary school chemistry teachers, by number of classes in chemistry, by region, and by other science classes, spring 1961*

Other science classes [1]	Chemistry teachers							
	Total	By number of chemistry classes			By region			
		1–2	3–4	5 or more	Northeast	South	North Central	West
Total	401	272	103	26	104	90	142	65
Physics	79	56	22	1	22	18	24	15
Biology	42	30	12	----	10	8	15	9
Biology and physics	21	20	1	----	6	6	5	4
General science	32	26	6	----	9	12	9	2
General science and physics	25	24	1	----	4	5	16	----
General science and biology	40	38	2	----	4	13	16	7
General science, biology, and physics	25	24	----	1	1	7	12	5
No physics, biology, or general science classes	137	54	59	24	48	21	45	23

[1] Only the three most frequently reported subjects are tabulated.

NOTE.—The entries are not cumulative; e.g., teachers reporting two subjects are counted only in the line specifying both those subjects. The total number of chemistry teachers with classes in physics is 150; in biology, 128; in general science, 122.

TABLE 30.—*Secondary school physics teachers, by number of classes in physics, by region, and by highest degree, spring 1961*

Educational level, by highest degree	Physics teachers							
	Total	By number of physics classes			By region			
		1–2	3–4	5 or more	Northeast	South	North Central	West
All levels	354	287	54	13	88	67	149	50
Associate	3	2	1	----	----	1	2	----
Bachelor's	188	162	22	4	36	40	84	28
Master's	155	118	29	8	49	26	61	19
Doctorate	4	2	2	----	3	----	----	1
Not reported	4	3	----	1	----	----	2	2
Percent master's [1]	44	42	54	67	56	39	41	40

[1] Computations exclude teachers who did not report highest degree.

TABLE 31.—*Secondary school physics teachers, by number of classes in physics, by region, and by highest degree and excess hours of credit, spring 1961*

Highest degree and excess semester hours [1]	Physics teachers [2]							
	Total	By number of physics classes			By region			
		1-2	3-4	5 or more	North-east	South	North Central	West
Bachelor's degree highest	188	162	22	4	36	40	84	28
Excess hours:								
Less than 10	51	48	3	0	9	13	25	4
10-29	65	53	10	2	15	12	30	8
30 or more	72	61	9	2	12	15	29	16
Percent 10 or more excess hours	73	70	86	100	75	68	70	86
Master's degree highest	155	118	29	8	49	26	61	19
Excess hours:								
Less than 10	53	43	7	3	17	10	21	5
10-29	66	48	15	3	23	10	25	8
30 or more	36	27	7	2	9	6	15	6
Percent 10 or more excess hours	66	64	76	62	65	62	66	74

[1] Semester hours in any course taken for credit after attaining the degree. [2] Excludes teachers who reported the associate or the doctoral degree as highest or did not report degree.

TABLE 32.—*Secondary school physics teachers, by number of classes in physics, by region, and by hours of credit in physics and mathematics, spring 1961*

Undergraduate or graduate semester hours in physics and mathematics	Physics teachers							
	Total	By number of physics classes			By region			
		1-2	3-4	5 or more	North-east	South	North Central	West
Total	354	287	54	13	88	67	149	50
Less than 9 hours in physics:								
Total	92	83	7	2	22	23	34	13
Mathematics less than 9 hours	51	47	2	2	10	12	21	8
Mathematics 9 hours or more	41	36	5	----	12	11	13	5
9-17 hours in physics:								
Total	146	115	24	7	32	30	60	24
Mathematics less than 9 hours	33	26	5	2	7	8	11	7
Mathematics 9 hours or more	113	89	19	5	25	22	49	17
18-29 hours in physics:								
Total	72	57	13	2	16	11	40	5
Mathematics less than 9 hours	6	4	2	----	2	1	2	1
Mathematics 9 hours or more	66	53	11	2	14	10	38	4
30 or more hours in physics:								
Total	44	32	10	2	18	3	15	8
Mathematics less than 9 hours	2	----	1	1	1	----	1	----
Mathematics 9 hours or more	42	32	9	1	17	3	14	8
Percent with at least 30 hours in physics	12	11	19	15	20	4	10	16

TABLE 33.—*Secondary school physics teachers, by number of classes in physics, by year of most recent graduate study in physics, and by year of bachelor's degree, spring 1961*

Year of bachelor's degree	Physics teachers, by year of most recent graduate study in physics [1]																	
	All teachers of physics in sample						Teachers with 1 or 2 classes in physics						Teachers with 3 or more classes in physics					
	Total	Before 1940	1940–49	1950–56	1957 or later	None [2]	Total	Before 1940	1940–49	1950–56	1957 or later	None [2]	Total	Before 1940	1940–49	1950–56	1957 or later	None [2]
All years	354	10	7	8	105	224	287	7	7	4	81	188	67	3	-------	4	24	36
Before 1940	100	10	5	3	25	57	79	7	5	2	17	48	18	3	-------	1	6	8
1940–49	64	-------	2	1	21	40	45	-------	2	-------	18	25	20	-------	-------	1	5	14
1950–56	106	-------	-------	4	46	56	86	-------	-------	2	34	50	18	-------	-------	2	9	7
1957 or later	76	-------	-------	-------	12	64	71	-------	-------	-------	12	59	10	-------	-------	-------	3	7
Not reported	8	-------	-------	-------	1	7	6	-------	-------	-------	-------	6	1	-------	-------	-------	1	-------

[1] Any physics course taken for credit after attaining the bachelor's degree.
[2] No graduate study in physics reported.

TABLE 34.—*Secondary school physics teachers, by number of classes in physics, by region, and by other science classes, spring 1961*

Other science classes [1]	Physics teachers							
	Total	By number of physics classes			By region			
		1–2	3–4	5 or more	North-east	South	North Central	West
Total	354	287	54	13	88	67	149	50
General science	45	36	9	----------	11	6	22	6
Mathematics 9–12	73	64	7	2	14	12	32	15
Mathematics 9–12 and general science	17	16	1	----------	6	2	8	1
Chemistry	69	59	9	1	18	21	17	13
Chemistry and general science	40	40	----------	----------	5	8	25	2
Chemistry and mathematics 9–12	31	30	1	----------	10	3	12	6
Chemistry, mathematics 9–12, and general science	10	9	1	----------	----------	4	3	3
No general science, mathematics 9–12, or chemistry classes	69	33	26	10	24	11	30	4

[1] Only the three most frequently reported subjects are tabulated.

NOTE.—The entries are not cumulative; e.g., teachers reporting two subjects are counted only in the line specifying both those subjects. The total number of physics teachers with classes in general science was 112, in mathematics 9–12, 131; in chemistry, 150. (For the number with classes in biology, see table 24.)

TABLE 35.—*Secondary school mathematics 7–8 teachers, by number of classes in mathematics 7–8, by region, and by highest degree, spring 1961*

Educational level, by highest degree	Mathematics 7–8 teachers							
	Total	By number of mathematics 7–8 classes			By region			
		1–2	3–4	5 or more	North-east	South	North Central	West
All levels	723	402	196	125	143	237	240	103
Associate	17	10	6	1	6	4	7	---------
Bachelor's	468	257	134	77	79	160	158	71
Master's	214	121	51	42	52	64	67	31
Doctorate	2	----------	----------	2	1	----------	1	----------
Not reported	22	14	5	3	5	9	7	1
Percent master's [1]	31	31	27	34	38	28	29	30

[1] Computations exclude teachers who did not report highest degree.

TABLE 36.—*Secondary school mathematics 7–8 teachers, by number of classes in mathematics 7–8, by region, and by highest degree and excess hours of credit, spring 1961*

Highest degree and excess semester hours[1]	Mathematics 7-8 teachers[2]							
	Total	By number of mathematics 7-8 classes			By region			
		1-2	3-4	5 or more	North-east	South	North Central	West
Bachelor's degree highest	468	257	134	77	79	160	158	71
Excess hours:								
Less than 10	216	118	70	28	40	76	78	22
10-29	164	94	38	32	26	64	56	18
30 or more	88	45	26	17	13	20	24	31
Percent 10 or more excess hours	54	54	48	64	49	52	51	69
Master's degree highest	214	121	51	42	52	64	67	31
Excess hours:								
Less than 10	113	65	27	21	21	42	37	13
10-29	64	33	17	14	22	15	18	9
30 or more	37	23	7	7	9	7	12	9
Percent 10 or more excess hours	47	46	47	50	60	34	45	58

[1] Semester hours in any course taken for credit after attaining the degree.

[2] Excludes teachers who reported the associate or the doctoral degree as highest or did not report degree.

TABLE 37.—*Secondary school mathematics 7–8 teachers, by number of classes in mathematics 7–8, by region, and by hours of credit in mathematics and physics, spring 1961*

Undergraduate or graduate semester hours in mathematics and physics	Mathematics 7-8 teachers							
	Total	By number of mathematics 7-8 classes			By region			
		1-2	3-4	5 or more	North-east	South	North Central	West
Total	723	402	196	125	143	237	240	103
Less than 9 hours in mathematics:								
Total	274	179	60	35	55	94	74	51
Physics less than 9 hours	258	169	58	31	51	89	71	47
Physics 9 hours or more	16	10	2	4	4	5	3	4
9–17 hours in mathematics:								
Total	130	66	36	28	24	46	41	19
Physics less than 9 hours	101	52	26	23	20	33	33	15
Physics 9 hours or more	29	14	10	5	4	13	8	4
18–29 hours in mathematics:								
Total	174	80	57	37	32	48	72	22
Physics less than 9 hours	118	52	39	27	22	39	46	11
Physics 9 hours or more	56	28	18	10	10	9	26	11
30 or more hours in mathematics:								
Total	145	77	43	25	32	49	53	11
Physics less than 9 hours	83	51	18	14	20	29	28	6
Physics 9 hours or more	62	26	25	11	12	20	25	5
Percent with at least 30 hours in mathematics	20	19	22	20	22	21	22	11

TABLE 38.—*Secondary school mathematics 7–8 teachers, by number of classes in mathematics 7–8, by year of most recent graduate study in mathematics, and by year of bachelor's degree, spring 1961*

Year of bachelor's degree	Mathematics 7–8 teachers, by year of most recent graduate study in mathematics [1]																	
	All teachers of mathematics 7–8 in sample						Teachers with 1 or 2 classes in mathematics 7–8						Teachers with 3 or more classes in mathematics 7–8					
	Total	Before 1940	1940–49	1950–56	1957 or later	None [2]	Total	Before 1940	1940–49	1950–56	1957 or later	None [2]	Total	Before 1940	1940–49	1950–56	1957 or later	None [2]
All years	723	6	5	25	112	575	402	4	1	16	53	328	321	2	4	9	59	247
Before 1940	140	6	1	3	24	106	82	4	-------	2	14	62	58	2	1	1	10	44
1940–49	105	-------	3	7	10	85	61	-------	1	4	4	52	44	-------	2	3	6	33
1950–56	221	-------	-------	11	51	159	116	-------	-------	7	20	89	105	-------	-------	4	31	70
1957 or later	216	-------	-------	-------	26	190	118	-------	-------	-------	15	103	98	-------	-------	-------	11	87
Not reported	41	-------	1	4	1	35	25	-------	-------	3	-------	22	16	-------	1	1	1	13

[1] Any mathematics course taken for credit after attaining the bachelor's degree.
[2] No graduate study in mathematics reported.

TABLE 39.—*Secondary school mathematics 7–8 teachers, by number of classes in mathematics 7–8, by region, and by other science classes, spring 1961*

Other science classes [1]	Mathematics 7–8 teachers							
	Total	By number of mathematics 7–8 classes			By region			
		1–2	3–4	5 or more	Northeast	South	North Central	West
Total	723	402	196	125	143	237	240	103
Mathematics 9–12	252	172	74	6	57	80	87	28
Biology	2	2	----------	----------	1	1	----------	----------
Biology and mathematics 9–12	5	5	----------	----------	----------	4	1	----------
General science	150	105	39	6	25	55	46	24
General science and mathematics 9–12	31	27	4	----------	8	11	6	6
General science and biology	8	8	----------	----------	----------	3	3	2
General science, biology, and mathematics 9–12	4	4	----------	----------	----------	1	2	1
No general science, biology, or mathematics 9–12 classes	271	79	79	113	152	82	95	42

[1] Only the three most frequently reported subjects are tabulated.

NOTE.—The entries are not cumulative; e.g., teachers reporting two subjects are counted only in the line specifying both those subjects. The total number of mathematics 7–8 teachers with classes in mathematics 9–12 was 294; in general science, 193; in biology, 19.

TABLE 40.— *Secondary school mathematics 9–12 teachers, by number of classes in mathematics 9–12, by region, and by highest degree, spring 1961*

Educational level, by highest degree	Mathematics 9–12 teachers							
	Total	By number of mathematics 9–12 classes			By region			
		1–2	3–4	5 or more	Northeast	South	North Central	West
All levels	1,351	450	431	470	311	355	458	227
Associate	11	3	5	3	3	4	3	1
Bachelor's	781	265	247	269	169	232	254	126
Master's	529	170	173	186	131	108	194	96
Doctorate	7	2	1	4	3	----------	2	2
Not reported	23	10	5	8	5	11	5	2
Percent master's [1]	40	39	41	40	43	31	43	43

[1] Computations exclude teachers who did not report highest degree.

TABLE 41.—*Secondary school mathematics 9–12 teachers, by number of classes in mathematics 9–12, by region, and by highest degree and excess hours of credit, spring 1961*

Highest degree and excess semester hours [1]	Mathematics 9–12 teachers [2]							
	Total	By number of mathematics 9–12 classes			By region			
		1–2	3–4	5 or more	North-east	South	North Central	West
Bachelor's degree highest	781	265	247	269	169	232	254	126
Excess hours:								
Less than 10	288	99	90	99	63	101	94	30
10–29	295	97	91	107	75	88	101	31
30 or more	198	69	66	63	31	43	59	65
Percent 10 or more excess hours	63	63	64	63	63	56	63	76
Master's degree highest	529	170	173	186	131	108	194	96
Excess hours:								
Less than 10	239	77	79	83	47	66	92	34
10–29	181	56	60	65	53	33	62	33
30 or more	109	37	34	38	31	9	40	29
Percent 10 or more excess hours	55	55	54	55	64	39	53	65

[1] Semester hours in any course taken for credit after attaining the degree.

[2] Excludes teachers who reported the associate or the doctoral degree as highest or did not report degree.

TABLE 42.—*Secondary school mathematics 9–12 teachers, by number of classes in mathematics 9–12, by region, and by hours of credit in mathematics and physics, spring 1961*

Undergraduate or graduate semester hours in mathematics and physics	Mathematics 9–12 teachers							
	Total	By number of mathematics 9–12 classes			By region			
		1–2	3–4	5 or more	North-east	South	North Central	West
Total	1,351	450	431	470	311	355	458	227
Less than 9 hours in mathematics:								
Total	201	119	53	29	65	53	35	48
Physics less than 9 hours	180	101	50	29	60	46	33	41
Physics 9 hours or more	21	18	3	0	5	7	2	7
9–17 hours in mathematics:								
Total	202	107	58	37	46	63	50	43
Physics less than 9 hours	145	68	44	33	33	51	34	27
Physics 9 hours or more	57	39	14	4	13	12	16	16
18–29 hours in mathematics:								
Total	422	135	144	143	73	117	173	59
Physics less than 9 hours	261	77	94	90	45	92	98	26
Physics 9 hours or more	161	58	50	53	28	25	75	33
30 or more hours in mathematics:								
Total	526	89	176	261	127	122	200	77
Physics less than 9 hours	275	33	93	149	64	75	88	38
Physics 9 hours or more	251	56	83	112	63	47	112	39
Percent with at least 30 hours in mathematics	39	20	41	56	41	34	44	34

TABLE 43.—*Secondary school mathematics 9–12 teachers, by number of classes in mathematics 9–12, by year of most recent graduate study in mathematics, and by year of bachelor's degree, spring 1961*

Year of bachelor's degree	Mathematics 9-12 teachers, by year of most recent graduate study in mathematics [1]																	
	All teachers of mathematics 9-12 in sample						Teachers with 1 or 2 classes in mathematics 9-12						Teachers with 3 or more classes in mathematics 9-12					
	Total	Before 1940	1940-49	1950-56	1957 or later	None [2]	Total	Before 1940	1940-49	1950-56	1957 or later	None [2]	Total	Before 1940	1940-49	1950-56	1957 or later	None [2]
All years	1,351	29	24	56	394	848	450	6	6	12	78	348	901	23	18	44	316	500
Before 1940	367	28	20	9	99	211	102	6	5	1	18	72	265	22	15	8	81	139
1940-49	242	-------	2	20	76	144	75	-------	-------	2	9	64	167	-------	2	18	67	80
1950-56	384	-------	-------	25	139	220	139	-------	-------	7	33	99	245	-------	-------	18	106	121
1957 or later	321	-------	-------	-------	78	243	120	-------	-------	-------	17	103	201	-------	-------	-------	61	140
No response	37	1	2	2	2	30	14	-------	1	2	1	10	23	1	1	-------	1	20

[1] Any mathematics course taken for credit after attaining the bachelor's degree.
[2] No graduate study in mathematics reported.

TABLE 44.—*Secondary school mathematics 9–12 teachers, by number of classes in mathematics 9–12, by region, and by other science classes, spring 1961*

Other science classes [1]	Mathematics 9-12 teachers							
	Total	By number of mathematics 9-12 classes			By region			
		1-2	3-4	5 or more	Northeast	South	North Central	West
Total	1,351	450	431	470	311	355	458	227
Mathematics 7-8	248	123	111	14	57	81	82	28
Physics	96	48	41	7	24	12	39	21
Physics and mathematics 7-8	8	4	4	----------	----------	3	5	----------
General science	86	61	20	5	18	26	24	18
General science and mathematics 7-8	33	26	7	----------	6	12	8	7
General science and physics	24	15	7	2	4	6	10	4
General science, physics, and mathematics 7-8	3	3	----------	----------	2	----------	1	----------
No mathematics 7-8, physics, or general science classes	853	170	241	442	200	215	289	149

[1] Only the three most frequently reported subjects are tabulated.

NOTE.—The entries are not cumulative; e.g., teachers reporting two subjects are counted only in the line specifying both those subjects. The total number of mathematics 9-12 teachers with classes in mathematics 7-8 was 294; in physics, 131; in general science, 146.

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